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THE NATURE-STUDY REVIEW

Vol. 1, No. 1 January, 1905

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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THE

NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

VOL. I JANUARY, 1905 NO. 1

INTRODUCTION

In introducing this, the first number of THE NATURE-STUDY REVIEW, it seems necessary to define the limits of the field which the journal will attempt to cover, because the term nature-study in the descriptive part of the title may be so variously understood at the present time. The different interpretations of nature-study for schools will be presented and discussed in this and later numbers of the journal; but here it may be said, without defense, that the aims and plans of the editorial committee are based upon an interpretation of nature-study in its literal and widest sense as including all phases, physical as well as biological, of studies of natural objects and processes in elementary schools. It is evident that from this general point of view nature-study includes all the "natural-science" studies of the lower school: the natural history of plants and animals (nature-study in its common and most limited sense), school-gardening and the closely allied elementary agriculture, elementary physical science, the physical side of geography, and physiology and hygiene with special reference to the human body. With all these phases of nature-study, and especially with their relations to each other in elementary-school education considered as a whole, THE REVIEW will deal.

Nature-study interpreted in such a wide sense must obviously draw its materials from the fields of the several sciences, and the working out of the problems must be through the united efforts of experts in the fields of biology, geography, physics and chemistry, agriculture, and education. Recognizing this need of coöperation from several points of view, it was decided as part of the initial plan for this journal that the editorial committee and the board

of advisers and collaborators should be representative of all the sciences whose fields are involved in elementary education. Moreover, while nature-study is primarily an educational movement for the lower schools, it also affects the science work of the higher schools, and therefore should be considered from the combined viewpoints of professional educators with practical acquaintance with the problems of the elementary schools and of university men who are primarily interested in nature-study as a preliminary phase of science-teaching. For this reason representatives of both schools and colleges are interested in the development of the new journal. Finally, the wide geographical distribution of the nearly seventy members of the editorial board insures that the journal will be entirely independent of local interests and free to become representative of nature-study in all parts of America, the center of the movement; and it is hoped that those interested in nature-study in all the States and in Canada will have a personal interest in the development of the journal as though it were the official organ of an American association of nature-study teachers. M. A. B.

NATURE-STUDY AND ITS RELATION TO NATURAL SCIENCE

A SYMPOSIUM BY H. W. FAIRBANKS, C. F. HODGE, T. H. MACBRIDE, F. L. STEVENS, and M. A. BIGELOW

[EDITORIAL NOTE.—The extensive correspondence connected with the founding of THE NATURE-STUDY REVIEW showed that in the minds of representative men of science and education there is great variation in the interpretation of what nature-study is supposed to be or should be. In fact, there were found eminent professors who were so firmly convinced that nature-study is simply a dangerous fad that they counseled against attempting to give the subject recognition in a special journal. But all this divergence of opinion should be not in the least discouraging, for the various opinions are simply outgrowths of the different local practices in the teaching of nature-study. Thus far nature-study in the United States has been developed in more or less local centres where leaders have by personal contact established their individual

schemes of nature-study. Hence it has come about that nature-study is understood to mean: (1) elementary agriculture; (2) simple object lessons on plants and animals; (3) informal teaching about natural things seen by pupils, for the sake of developing interest and habits of observing; (4) serious elementary biology and physical science; (5) popular picnics in the woods; (6) sentimental talks and reading about plants and animals; (7) "teaching children to love Nature"—these and all their possible combinations and probably still other points of view are found in the current interpretation and practice of nature-study in the United States. Such variation is not surprising, for the natural processes and materials with which nature-study in any form has to deal are extremely variable in their distribution, and therefore so far as facts are concerned the nature-study in one locality can not be the same as that in another. From a Maine forest to a wheat field in the Dakotas is a transition to quite a different world; but in spite of the difference in materials available for study it seems reasonable to believe that educationally the study of the objects of the immediate environment ought to lead the Maine and the Dakota pupils to the same essential result. In other words, if nature-study is anything more than local manifestations of a widely distributed fad, there ought to be found some fundamental principles concerning whose educational and scientific value there will be general agreement. The science of biology is taught in the colleges on the basis of materials locally available, and yet there is such general understanding and agreement regarding the fundamental principles that in all essentials of a general biological education the students of the Australian colleges have equal advantages with their contemporaries in England, Germany, and America. The situation with regard to nature-study is exactly parallel. There is need of agreement and uniformity concerning the fundamental principles by which the teaching about any particular natural object or process may be guided. In search of such agreement it is necessary, first of all, that the conflicting views as to what nature-study is in education should be brought together for comparison and discussion. This will be attempted in THE NATURE-STUDY REVIEW; and we open the discussion of fundamental questions by presenting this month a series of brief papers which attempt to point out the differences between nature-study and natural science—two terms which are commonly regarded as quite synonymous.]

I

BY HAROLD W. FAIRBANKS, PH.D.

Berkeley, Cal.

In attempting to frame a definition of nature-study I may be undertaking something which cannot be accomplished to the satisfaction of every one, and yet all will agree, I think, that the subject must be more sharply and clearly stated if we would have it productive of the most good in our schools. One has only to look over the literature of nature-study to see how varied are the standpoints of different teachers with reference to the subject.

Some teachers hold that the chief object of nature-study or science, for they use the terms interchangeably, is the acquisition of facts, and consequently fill the course of study with a mass of materials which are to be studied in a scientific manner. Other teachers hold that the subject is valuable chiefly for its training of the mind and senses, and for its power to arouse an interest in and love for the world about us. With the first class the subject-matter and its manner of presentation are all important, with the second class the subject-matter is considered immaterial as long as the desired training of the senses is brought about. The extremes of these two schools are far apart, and represent radically different standpoints, but there are many intermediate views held.

The term nature-study, it seems to me, may be appropriately used for all that direct observation and study of natural phenomena which belongs within the province of the elementary school. Nature-study has to do with the raw materials of science. but it is not science as that term should be used. It is not even elementary science, if by science we mean the coördinating, arranging, and systematizing of the facts of nature. Facts will be acquired but that is not the main object.

Nature-study differs from the older system of "object teaching" in dealing more directly with phenomena in their natural relations, less with isolated "objects." Nature-study is less formal and the cultivation of language and expression is incidental. There must be some system in any properly arranged course of nature-study, but not an inflexible one. The teacher should be permitted to emphasize those aspects of nature with which he is most familiar, and the work should be further determined by the physical environment of the school.

For the first four years of school, that is, throughout the primary period, nature-study and geography are practically identical. Theoretically, however, we may distinguish "home lore" from a geographic treatment of the home and its surroundings. Above the fourth grade nature-study and geography diverge in practice, although to make the most of both subjects, lessons in one should be arranged as far as possible with reference to lessons in the other.

Nature-study calls for action on the part of the pupil. He should discover the meaning of facts for himself, and not ordinarily go to the teacher or to books. His own experience should form the basis of what he acquires.

There should be a gradual shifting of emphasis in nature-study throughout the elementary school. The distinction between nature-study and science is most marked in the lower grades. Here the emphasis is laid upon the side of interest, upon the training of the mind and senses, and the materials studied should be from the home environment. In the more advanced portion of the course, although the subject should still be developed from the side of interest, there must come an increasing use of the reasoning powers, and a greater value attached to the choice and use of material.

With the beginning of the secondary-school period method is more exact, there is a deeper inquiry into causes and relations, and we may be said to have reached the scientific study of nature.

There is no break in the development of the powers of the child between the kindergarten and the college, and the lessons in nature-study, beginning with the home region, must be graded to suit the expanding capacities. Nature-study must blend into science study with no break between school periods.

The pupil should come to the secondary school with a keen interest in the study and observation of natural phenomena, and if the work in the latter school is not too ambitious, he does not have to unlearn upon reaching the college a mass of pseudo-science taught him when he was too immature to comprehend it properly.

Nature-study should give primarily that training which the savage child acquires, but should carry it much farther. The savage child acquires an untechnical knowledge of wood-craft, of the habits and characteristics of the birds and animals, of the signs

of storm, and of the dangers which lurk about him. Experience sharpens his senses and gives him a working knowledge, which although not consciously reasoned out, or systematized in any way, yet serves him in time of need.

The children of civilized races are shut away in too many instances from a free contact with nature; their needs are so provided for and dangers guarded against, that they grow up with undeveloped capacities and in almost total ignorance of the world of nature. How much more they would make of their surroundings, and how much more these surroundings would heighten their interest and zest in life if they were able to appreciate them in even a very simple way.

Nature-study should lead the child back to this natural intimacy with nature and to delight in her company. This cannot be done by feeding him upon courses of study made up of scientifically arranged facts, but by fitting him in a broad way through the exercise of his observational and reasoning powers so that he not only takes pleasure in the world around him but is able to use it more fully to his material advantage.

II

BY C. F. HODGE

Clark University

"I doubt not but ye shall have more ado to drive our dullest and laziest youth, our stocks and stubs from the infinite desire of such a happy nurture, than we have now to hale and drag our choicest and hopefullest wits to that asinine feast of sow-thistles and brambles which is commonly set before them, as all the food and entertainment of their tenderest age." —John Milton, "Tractate on Education," p. 8.

There is a suggestive analogy between eating and learning. In the one process food is built into the bodily life, in the other truth is assimilated to the mental life. Both functions are equipped with a complicated set of organs and both require a certain amount of effort or work. *"De gustibus non est disputandum";* and still it is interesting to inquire why it is that eating or learning some things is pleasurable and wholesome, while learning or eating something else may be distasteful and injurious. In general, if the physical appetite is sharp enough, the taking of food, however plain, is agreeable; and, if food is not to be had, I suppose a Digger Indian may derive some satisfaction from eating

clay. In general, too, it is difficult to induce children to eat anything that is distinctly distasteful to them, and under conditions of normal health and appetite this is not necessary, their natural tastes and desires being our safest guide. We do not think of feeding non-nutritious substances for the sake of "strengthening" the stomach; although the experiment has been tried of giving a piece of sponge to a frog's stomach to see how the cells would react. It was found that the cells secreted vigorously but failed to recover their original condition as they did when supplied with food. I have little doubt that a similar calamity in the learning mechanism results from the effort to master subjects that do not prove to contain some nutriment for thought and the mental life.

Science is a sort of military ration of a special few. Nature-study should be the daily bread of all alike. The attempt to force the army ration on the children of the country under the name of "elementary science," or often mistakenly called nature-study, has resulted in no end of misunderstanding and confusion.

In attempting to answer the question, "What is nature-study as distinguished from elementary science," it must be understood that this discussion deals solely with the biological side: i. e., What is nature-study of animals and plants as distinguished from technical botany and zoology. Fortunately, there are others who will speak for the other phases of the problem. Our particular question thus becomes: What knowledge about animals and plants ought to constitute the course in nature-study for elementary schools?

It is easy to define botany and zoology as the scientific treatment of animals and plants in regard to structure, arrangement, development and classification. All attempts to introduce these sciences into elementary instruction had proved failures as long ago as Charles Dickens wrote "Hard Times," and every effort to force them into the curriculum since that time has only served to heap up the evidence against them. Finally, to escape the odium of the Thomas Gradgrind-Mr. McChoakumchild regime the very name "elementary science" had to be dropped and the wholesome term "nature-study" substituted; and the gravest danger now confronting this new movement is that we forget the lessons of the past and persist in trying to teach children formal science adapted to maturer years. After acquaintance with a

number of common animals and plants has been attained the value of scientific methods may be appreciated.

The greatest difficulty just now in making a clear distinction between nature-study and science in practical teaching is concerned with the purely scientific training of the teachers. They have had technical biology—or botany and zoology—either in college or in normal schools under college educated instructors. They have not been given the nature-study point of view; and consequently, when they are called upon to give lessons on animals and plants, they have nothing else and hence can teach only college science. This situation has drawn the dreariest train of absurdities in its wake to be found in our whole educational system—"lessons"(?) in the classification of animals and plants the children have never seen or heard of, technical details of form and structure which, with the difficult terminology, are wholly meaningless and unrelated to any interests of either the children or the community.

Nature-study, as I conceive it, is so natural and easy and so refreshing to teachers and pupils alike that a frequent reaction among teachers, I find, is: "Why, this is too good fun. You really do not call this work, do you?" Well, call it what you please, but the more freedom, spontaneity and delight there is, for both teacher and pupils, the better nature-study it is. These are just the things that will develop genuine love of nature, one ounce of which is worth in life-value pounds of mere acquisition of facts. All I ask of nature-study is that it bring the child out at fourteen with a genuine and abiding love of nature; and the thing that has stirred me to the quick in this whole subject is the hatred and the consequent abuse of nature which Gradgrind methods develop in the child.

In order to develop love we need not only acquaintance but intimacy, and intimacy requires time. Love is active. It is the great motive source of action in the world. Its best definition is: "the desire or passion to do good to the object loved." Hence, translated into these terms, we should have as the end result of our nature-study the abiding desire to do good to the nature in which we live. But the good in nature is set off, bounded and defined by the evil. A child cannot love the plants in his garden without pulling the weeds and destroying the insects that would harm them. So with trees and birds and the whole list of nature inter-

ests. Since life itself is a struggle, wherever we raise a love we define a possible line of battle; and we are all in the world to fight the good fight. Turn whichever way we will, it is only trifling to attempt to escape this conflict, and, hence, the line between the good and the evil in nature is essential in selecting the matter which we include in our course in nature-study. In other words, the good and the beautiful are realities upon which human life and interests have taken fixed and definite hold. Bring the child into acquaintance and intimacy with the proper things and his love flows out to them as naturally as water flows down hill. If we attempt to force upon him false relations and values, we have the futile task of trying to turn the stream up hill.

Success or failure of the whole movement depends on the subject-matter selected. If that is rich in universal human interest and value, we shall hear no more about "waste of time on fads" and "new fangled notions," and nature will be accorded its rightful place as a great source of nourishment for our educational life.

III

BY PROFESSOR THOMAS H. MACBRIDE

State University of Iowa

I am asked to discuss briefly the question, What is nature-study, and especially to point out the distinction, if such exist, between nature-study and natural science as offered in the higher schools.

The problem seems to me by no means difficult, theoretically at least; in practice science-teaching in elementary courses may, and probably should, include the nature-study idea as incidental. Nature-study is simply a sympathetic attempt to bring known truth concerning the natural world to the attention and comprehension of those who would learn. All that is offered in nature-study to-day will be, of course, in accordance with the principles of art and science; art, in so far as it pertains to the discussion of the beauty of outward form, science in all that pertains to exact detail, whether of form, history, or underlying relationship and origin. In other words, real nature-study is based upon real science; differing from the more formal presentation of scientific truth only in that it is less comprehensive, less complete, and indeed holds in view a different immediate purpose. The purpose of the study of science is primarily the attainment of truth, of all

truth; the purpose of nature-study is rather the development of sentiment or possibly the acquisition of some bit of expert information. If, for example, we study the deer as a matter of science, we seek to learn all about his structure, his relationships, genesis, habits, etc.; as students of nature-study we may choose to ignore many of these things and think of the deer only as a beautiful living creature, having certain habits and relations to our parks and forests. But, it would not do to consider the deer as having horns like those of a cow, or as making in the forest foot-prints like those of a colt, or paths like the streets of a city. Nature-study when dealing with animals is real zoölogy; it may not declare the entire body of known scientific truth in the particular case, but at least it will in no particular contravene zoölogical fact. And so when dealing with plants; nature-study is botany so far as it goes. It is not myth, it is not nonsense, nor childish legend, it is truth, scientifically ascertained and supported, truth, simply and clearly stated.

There are, however, it would appear, very many people, even teachers, who so little appreciate the simple truth of science, as to esteem it dry and of itself uninteresting. The life-history of the barnacle does not appeal to such at all; they much prefer the tale of the barnacle-goose. Such people will always prefer barnacle-goose stories, whether of the sixteenth century or of the twentieth, and for these real nature-study is out of the question. Unfortunately, such people still persist in believing themselves true nature-students and too often write volumes for the guidance of others. People who by actual experience know nothing about the natural world, by the aid of such books find themselves competent to teach nature-study, or in the language of the schedules, to undertake "the nature-work," and the blind go on leading the blind into a maze of fable and foolishness to which the history of education in recent times affords scarcely a parallel. Books of this sort are so numerous that they need not be here cited. All this kind of thing has served to bring the nature-study effort into disrepute, and many eminent men of science and of the schools look upon the whole matter as superficial, insincere and hence mischievous in the extreme. The remedy lies in the definition and encouragement of real nature-study, as against every fad and fashion whatsoever. Nature-study to be of any service at all, must concern itself primarily with the truth, whatever the ulti-

mate purpose. Surely in all the splendid panorama of the living world there is enough to excite our intelligent interest; surely enough to arouse our warm sympathy with these forms of beauty and loveliness, albeit leading lowly lives, yet lives of contentedness, happiness and purity,—surely in all this there is enough to waken the sympathy and interest of every intelligent, sentient soul, without metaphor, without artifice or stimulus of any sort. The greatest teacher of the world bade us consider the lily "*how* it grows"; who of his followers in all the 2,000 years can solve the problem? The simplest problems of nature are all about us, yet far-reaching to exhaust the most cunning artifice of our inquiry; but we heed them not. Look at the splendor of our autumn fields of corn; where are the people in all these thousand schools that know the secrets of the corn? Who knows the meaning of the sunflower, the aster, or how the chrysanthemum comes by its wealth of pearl and gold, and yet anon is purple? Who knows where the bobolink builds his nest, or why he is lost to-day in that swarthy swarm that marks the assembly of the blackbird clans all moving to the South? Who knows the path of the wild-duck in his flight and why from year to year he courses back and forth, weaving the web of his destiny in the vaster mystery of terrestrial life? Who shall teach the farmers and sportsmen of our country that to shoot these birds in spring is destruction, a barbarism that even the savage Indians were unwilling to commit?

But why shall nature-study be limited to plants and animals alone? Among the text-books offered nowadays, there are some which are much more comprehensive; they take up in simple way the phenomena of the inorganic world. This is to be commended. Why, for instance, should our people be almost universally ignorant of the simpler facts about the stars? Primitive men, men at least of whose attainments their descendants are not inclined to boast, long ago learned to read the shifting movements of the planets, but there are to-day millions of men in the United States who know not the first thing about the nightly heavens. Is there any reason why an agricultural people should not find nature-study in the processes which concern the making and distribution of the soils? The simple truths of geology are everywhere patent, not in books, not in pictures, but in fact; in the streets, in the field and garden, by the roadside, written on scratched pebbles.

sculptured on all the hills. Why may not such facts constitute the theme of genuine nature-study, to the great and never-ceasing profit and advantage of by far the larger part of our population?

But however all this may be, it still remains, that in all our nature-study we must take care that we so use the facts of nature that our children learn to judge wisely and discriminate truth from fancy and error, and any view or treatment of the natural world which is inconsistent with the known methods and facts of science will ever prove disastrous at the last, called by whatever name, nature-study or not, no matter how lofty our professed intentions, how noble the purpose we declare.

IV

BY PROFESSOR F. L. STEVENS, PH.D.

North Carolina College of Agriculture and Mechanic Arts

With the subject so broad in scope, so indefinite in administration, so capable of variation, and withal so new, there is little wonder that nature-study is misunderstood by many; that it is confounded with botany, zoölogy or geography on the one hand, or with agriculture and studies of the industries on the other. It is not surprising that attempts to define nature-study have failed, that written definitions are as numerous as are writers upon nature-study, and that conceptions of the subject are almost as many as are the teachers who attempt nature-study. The vastness of the subject leaves almost infinite liberty to the teacher in the selection of matter. Hundreds of elementary courses could be planned, yet not trespass upon one another. None of that elimination, leading to mutual agreement as to the most desirable topics, has yet occurred, as it has with such sciences as chemistry and physics. These sciences, moreover, deal with fundamentals, and it is a necessary consequence that one elementary course in a given science is much like another in the same science. The principles to be taught are the same, the method chiefly varies.

Nature-study on the other hand does not deal with fundamentals. It concerns itself with details. Fundamentals are few; details are infinite. One of the chief differences between science and nature-study rests upon these facts. They are fundamental and they will operate to retard, if not to prohibit forever, any rigidity in the nature-study outline. The great variation in subject-matter gives almost limitless plasticity to the course.

Another fundamental distinction between science and nature-study is that the latter as recognized by the great majority of its promoters is a study of natural objects, not books. Science may be a study of either books or natural objects. The essence of science is the subject-matter. The essence of nature-study is the method. While the subject-matter of nature-study varies almost endlessly, its method is its characteristic. Vary the method beyond certain limits and it is no longer nature-study. Nature-study and science are in these attributes distinguishable.

Nature-study is not science, it is none of the arts. It differs from both in motive. Science has for its end the acquiring and teaching of facts, laws, or principles; an art to do or accomplish or construct. Nature-study does neither primarily. It may do both extensively though incidentally. The function of nature-study is to increase interest, to awaken the power of observation, and to open the eyes of the child so that he may see the beauties of nature that abound unrecognized about him. The difference in motive between the sciences or arts and nature-study is therefore fundamental.

The field of nature-study is broader than that of any other subject in the school curriculum. The motive of nature-study precludes dogmatic selection of any specific subject-matter from this field. That subject-matter is best which in the hands of a given teacher with a given school and environment will arouse wholesome abiding interest in nature. The value of systematic outlines is therefore less than in the case of the information subjects. Outlines are valuable for their suggestiveness chiefly. They may become stumbling blocks if misunderstood to be rigid guides.

A subject so broad is capable of division and special suggestive nature-study courses may be devised to meet the needs of special conditions: agricultural for the farming sections, strongly flavored with rocks for the mining regions, abounding in marine topics for the seaboard, and painfully elementary for the tenement dweller.

Nature-study is now in its embryonic condition. Its future development must see its differentiation; but the spirit, method and motive must remain or it will either abort or degenerate into elementary science, a possibility which no enthusiastic lover of nature will admit.

V

BY M. A. BIGELOW

Teachers College, Columbia University

The term nature-study has come into common use to designate (1) various phases of teaching about nature in common schools, and (2) popular study of natural history outside of schools by either children or adults. In both these cases the term has been commonly limited to the biological aspect of nature, and both the school and popular phases of nature-study are quite similar in the subject-matter and in the general aims and methods of study. We may, therefore, discuss nature-study for elementary schools with the understanding that so far as general principles are concerned the discussion will apply equally well to school or popular nature-study as these together are contrasted with natural science of the high schools and colleges.

What should be the nature-study for the elementary school, and what its relation to natural-science study in the higher schools? As the term nature-study etymologically suggests and as current practice indicates, the subject for the lower school deals with the same groups of natural materials which give the basis to the natural-science work of the higher schools. Is this parallelism simply another duplication in our educational system? If so, such duplication requires strong defense. Or is the nature-study simply a translation of elementary science into "words of one syllable" in adaptation to the capacities of very young pupils? Or is nature-study in some striking respect different from the natural sciences of the higher schools? These are fundamental questions which so far in the progress of the nature-study movement have not received the general attention which they deserve.

In the beginning of our discussion we must clearly define what we understand by natural science in the strict use of the word science. According to Karl Pearson, in his "Grammar of Science," "the classification of facts and the formation of absolute judgments upon the basis of this classification essentially sums up the aim and method of modern science. . . . The classification of facts, the recognition of their sequence and relative significance, is the function of science." Mivart, in his "Groundwork of Science," refers to science as "ordered and systematic knowledge." These agree essentially with the familiar, short and gen-

erally accepted definition that "science is organized knowledge," from which it follows that natural science is organized knowledge concerning natural objects and processes. Note that *organization* is the essence of this definition, as of those above. "Science differs from mere knowledge by being a knowledge both of facts, and of their relations to each other. The mere random, haphazard accumulation of facts, then, is not science; and the perception and conception of their natural relations to each other, the comprehension of these relations under general laws, and the organization of facts and laws into one body, the parts of which are seen to be subservient to each other, is Science." This clear and concise statement by the late Professor Joseph Payne, of London, in a lecture on "True Foundation of Science-Teaching" (1872) will, I think, meet with the approval of all scientific men who use the word science in its strict sense, as distinguished from the loose popular usage of the word to mean simply any grouping of facts about natural objects and processes.

The above definitions of science as organized knowledge may be well illustrated by a brief examination of the old-time natural history. This originally dealt with all phases of nature, but in the last century came to be commonly understood as limited to living nature—plants and animals. For our purposes let us briefly consider the animal side of natural history. Historians of science have written that the foundations of the science of zoölogy were laid in the latter half of the eighteenth century. This does not mean that in this century men first began to study and to collect facts about animals, for long before Aristotle many observers of animal life in its familiar forms accumulated much knowledge about animals, and Aristotle and later naturalists added great contributions. But all this mass of facts about animals lacked, before the middle of the eighteenth century, that organization under principles and generalizations which is characteristic of the modern science of zoölogy. Zoölogy, then, is not simply the study of animals, as it is often loosely defined; but it is an organization of knowledge concerning animals, and the founding of the science in the eighteenth century was not so much due to discovery of numerous new facts as to comparison and organization of facts which had been accumulating throughout many centuries. And so we have come to distinguish between modern organized knowledge under zoölogy and the former un-

classified accumulations of facts about animals which were then known as natural history. This happens to be a very appropriate term, for the word " history " here involves no idea of chronology, but was directly derived from the Greek title of Aristotle's work on animals in which connection the original " historia " meant records of investigation or information obtained by researches; from this natural history meant a record of studies of nature, and the phrase literally and by strict usage involved no idea of organization and generalization such as is understood in the modern natural sciences. Organization on the basis of classification of facts and generalizations is, then, the one fundamental difference between the old natural history of animals and the new science which we know as zoölogy.

I have used the history of the study of animals to illustrate the difference between the mere accumulation of facts about nature and the organization of the facts into science. In like manner we might find illustration in any other natural science; as, for example, we might have traced the records of the old alchemists who built up a chemical natural history—a record of facts without the atomic theory and the other generalizations which have organized the facts into the modern science of chemistry. Other illustrations are unnecessary for our present purpose; but the one point which must be emphasized is that the early studies of nature in all its phases were concerned chiefly with observing and accumulating facts because of man's interest in nature for its own sake, rather than for the sake of contributing to organized scientific knowledge for science's sake.

This is the place where I wish to draw the distinction between general nature-study and natural science—two phases of the study of nature. Here is the difference: nature-study, which in its subject-matter is only a modern educational form of the old-time general natural history, deals with facts primarily for their own sake without particular regard to organization into a system; on the contrary, modern natural science deals with facts primarily as they stand related to generalizations. Nature-study deals with the simple facts of nature as these are related to man's general interest in them; but natural science deals with facts, both general and detailed, as they fit into one vast scheme of generalizations. In nature-study for elementary and popular education the general acquaintance with natural things is essential; but in science

we want facts which we can correlate and classify with other facts and so add to or illustrate principles of the science. Or putting the whole matter in other words, nature-study appeals to us æsthetically and morally—we feel the value of acquaintance with natural objects and processes without perhaps being able to state the reason why; but natural science appeals to us intellectually and philosophically—we measure values of facts according to their relations in our system of knowledge. We see that the difference is in the view-point, rather than in the materials; but so far as studies of nature concern the earliest stages of education and popular information it is obvious that the difference is a fundamental one.

We have answered our leading questions. The difference between the nature-study of the elementary school and the natural science of the higher schools should not be simply one of amount of detail and simplicity of language, and true nature-study is quite different from elementary science in the strict sense, because nature-study should not deal with the introduction to formulated principles at which all high-school and college text-books of *real* elementary science aim directly.

These considerations lead to the following summary by way of condensed definitions: Nature-study is primarily the simple observational study of common natural objects and processes for the sake of personal acquaintance with the things which appeal to human interest directly and independently of relations to organized science. Natural-science study is the close analytical and synthetical study of natural objects and processes primarily for the sake of obtaining knowledge of the general principles which constitute the foundations of modern sciences.

Space here will not permit more than a statement of the proposition that all studies of natural objects and processes in the elementary school should be nature-studies as defined in the discussion above, because true elementary science with its very foundation in classifications and generalizations is not adapted to pupils as young as those in our elementary schools. This is not at all a radical position, for the truth is that little real elementary science has been successfully presented below the second year of high schools, most "sciences" in lower schools being simply so designated because the word is popularly misunderstood as meaning any study of nature.

I fail to see any sound foundation for distinction between nature-study and natural science except on the basis of generalizations, as above discussed. With regard to methods of study, it is generally agreed that in nature-study, as in natural science of the high schools and college, actual study of the natural objects and processes is the one sure basis for the teaching. Of course, there must be some limitations of the scientific method as applied to nature-study; but, as will be pointed out later, these are of minor significance. And with regard to materials for study, it must be obvious that this offers no good ground for attempting to draw general boundary lines.

In conclusion, it should be said that the above emphasis upon organization and generalizations as the fundamental distinction between nature-study and natural science must not be misunderstood as meaning that the writer is taking a stand for unsystematic nature-study, or for nature-study which is utterly unscientific. On the contrary, it seems certain that a very complete organization of the studies in the schools must soon be made in order to make nature-study most efficient in education. But such educational organization is quite independent of scientific organization upon which modern sciences are founded. Systematized nature-study may well pave the way for true science study, but this is an incidental result.

PHYSICAL NATURE-STUDY

BY JOHN F. WOODHULL
Teachers College, Columbia University

No one supposes that nature comprises only plants and animals, yet the term nature-study has been quite generally used in that exclusive sense. It is certain that botanical and zoological nature-study are much more common than physical nature-study. The reason for this probably lies not in the nature of the subject nor in the nature of children, but rather in the fact that persons interested in botany and zoology have been more zealous than the teachers of physics and chemistry in the performance of their duty toward the elementary-school pupils.

Certain it is that children are greatly interested in mechanical toys, in wind-mills, water-wheels, air-guns, sail-boats, steam-en-

gines, magnets, compasses, lightning, electric batteries, bells, motors, mirrors, prisms, magnifying glasses, whistles, harmonicas, all kinds of machinery and physical phenomena in general. Will any one undertake to say that children are more interested in plants and animals than in these, or that the realm of biology presents simpler facts and relations than the physical world? While the systematic study of physical phenomena belongs to a later period, children from ten to fourteen years of age have an inextinguishable interest in them and will study them whether we help them or not.

Physical nature-study deals with facts and relations in the field of physics and chemistry which the children of elementary-school age need to know for intelligent and happy living.

Possibly teachers of physics and chemistry have been too much hampered by their allegiance to the inductive method. They have scrupulously avoided the giving of information. They have even refused to make use of simple and direct means of illustration. Other departments give information freely and thereby secure a strong hold upon the pupils. Why should the department which has the most interesting and most valuable information, information which has a very practical bearing upon daily life, be so chary of it? This was not the attitude of Faraday, Tyndall, Clerk Maxwell, and of many other leaders in the field of physical science—past and present. But among the teachers of physics and chemistry in the public schools of to-day there certainly is greater indifference to the needs of the elementary-school pupils than is shown by the teachers of other departments of knowledge.

The Nature-Study Review will welcome contributions which will indicate that the foregoing statements are no longer true. Teachers and others are invited to make this journal the channel for communicating their ideas on physical nature-study—its methods, limitations, etc.

NATURE-STUDY AND ELEMENTARY AGRICULTURE IN CANADA

[EDITORIAL NOTE.—The following account of the new and very interesting movement in Canada has been based upon printed matter and other information supplied by Dean Muldrew of Macdonald Institute.]

Beginning with the present school-year the nature-study movement in the rural schools of Canada will surely make great progress, because the Macdonald Institute for teachers and the model rural schools will have their organizations complete and most of the buildings ready for work. Readers of Canadian periodicals of 1902 will remember that in that year Sir William C. Macdonald, of Montreal, authorized Professor James W. Robertson, Commissioner of Agriculture for the Dominion of Canada, to lay before the Premier of the Province of Ontario an offer of assistance to carry out a plan, submitted at the same time, for the improvement of education at rural schools; and for the establishment of courses of instruction and training in domestic economy or domestic science, at the Ontario Agricultural College. This plan included assistance towards: (1) The establishment of a model consolidated rural school in Ontario and one in each of four other Provinces of the Dominion. (2) Providing travelling instructors in nature-study for groups of rural schools in Ontario and other Provinces. (3) Providing courses of study and training in nature-study for teachers in rural schools. (4) Providing courses of instruction and training in domestic science for young women from country homes, and others.

In order to give effect to parts 3 and 4 of the above plan, the sum of $175,000 was offered to the Province of Ontario, on certain conditions, in January, 1902, and was accepted by Order-in-Council of the Provincial Government in March of the same year. As a result of this magnificent gift there have been erected, as a department of the Ontario Agricultural College, at Guelph, the Macdonald Hall, a residence for women students, and the Macdonald Institute, for the instruction of farmers' daughters and others in domestic science and domestic art, and for equipping teachers in nature-study, manual training, and home economics. By a liberal interpretation of the original agreement, the Province of Ontario undertakes the maintenance of these buildings, in perpetuity, and provides instruction in the courses suggested above,

with considerable extensions that have been thought desirable in the various departments.

Nature-study is now engaging the attention of educators at home and abroad, both as essential to a general education and as a preparation for intelligent agriculture. To equip Canadian teachers with the necessary knowledge and skill for making proper use of the simple materials furnished by nature is one of the aims of the Macdonald Institute, and courses in nature-study and school-gardening are offered to actual teachers as a preparation for this important branch of education. Such courses are of two kinds, three months' courses and full-year courses.

It was provided by the original agreement with Sir William C. Macdonald that, for a period of three years, five rural teachers from each of the older Provinces of the Dominion should be entitled to a three months' course in nature-study without payment of fees. At the same time a fund was provided from which such teachers will receive during the first year (1904–05) 5 cents per mile towards traveling expenses, and $25 to every approved teacher who has taken a full course to the satisfaction of the President and the Dean. It was expected that the Governments of the various Provinces would supplement this assistance by granting aid to worthy teachers wishing to take such a course. The expectation has been fully realized by the recent action of the various governments. In this way there have been offered for the term beginning September 13, 1904, the following scholarships for teachers of rural schools: Nova Scotia, 8; New Brunswick, 8; Prince Edward Island, 5; Quebec, 5; Ontario, 14, making a total of 40. Of this number about one-quarter will be offered to men receiving $75 each, and about three-quarters to women receiving $50 each, so that these teachers will receive from $75 to $100 each in addition to the mileage allowance for travelling expenses. Since there are no fees or other charges, except for board and lodging this will allow a large number of teachers to take advantage of this instruction without pecuniary cost to themselves. The appointments to these scholarships will be made by a committee, acting with the Minister or Superintendent of Education in each of the Provinces concerned. Inquiries for further information, or applications for appointment, should be addressed to the Departments of Education of the respective provinces mentioned above.

The one-term course will aim especially to prepare teachers to take up nature-study with their pupils, in connection with a school-garden and to deal with the simpler aspects of general nature-study. It is open to actual teachers; except that those not appointed to scholarships as above will be required to pay the regular fee of $10.

In some of the Provinces a special grant is paid by the Government to schools which take up work of this kind, under instructors who are properly qualified. This bonus may be divided between the teachers and the school. In such case it is expected that the successful completion of the above course will be accepted as the teacher's qualification, and it is probable that similar regulations will be adopted in all of the Provinces.

A more advanced course of a similar nature and extending over a full college year is given to teachers who wish to qualify as specialists in this department. Only teachers holding permanent professional certificates are eligible for entrance. The aim is to provide instructors fitted to carry on the work of nature-study and school-gardens in a group of rural schools, in a large consolidated school, or in an agricultural high school.

SOME RECENT CRITICISMS OF NATURE-STUDY

From papers by Professor McMurry, of New York, and Professor Armstrong, of London

In a paper on "Advisable Omissions from the Elementary Curriculum, and the Basis for them" (*Educational Review*, 27: 478–493. May, 1904) Professor F. M. McMurry of Teachers College, Columbia University, points out that the present elementary-school curriculum is so seriously overcrowded that omissions are demanded. An examination of the various school subjects leads him to the conclusion that not one can be spared from the curriculum; and omissions, then, must be confined to particular topics and details.

Six standards for selecting have in the past guided choice of subject-matter, namely: utility, the child's ability, the child's interest, truth for truth's sake, harmonious development of all faculties, and thoroughness. From a discussion of these Dr. Mc-

Murry concludes that the following propositions should hold in the rejection of subject-matter: (1) Whatever cannot be shown to have a plain relation to some real need of life, whether it be æsthetic, ethical, or utilitarian in the narrower sense, must be dropped. (2) Whatever is not reasonably within the child's comprehension, likewise. (3) Whatever is unlikely to appeal to his interest; unless it is positively demanded for the first very weighty reason. (4) Whatever topics and details are so isolated or irrelevant that they fail to be a part of any series or chain of ideas, and therefore fail to be necessary for the appreciation of any large point. This standard, however, not to apply to the three R's and spelling.

Applying these suggestions to various subjects in the schools, Dr. McMurry writes as follows with special reference to nature-study:

"In one of our best schools I was recently present while a second-grade class reached the conclusion that grasshoppers habitually lived in dry, sunny places, the children, when playing, having seen them there. They decided that the insect went under boards and rocks when it rained, and some related how they had fed some captive grasshoppers apple and water.

"I saw a fifth grade write out a description of a dead red oak leaf, the paper nearest me reading as follows: Size, 7½ inches long; 4 inches widest part; shape, somewhat oval—widest at top; lobes, alternate, long pointed, 10 lobes on leaf; indentation, 10 indentations, rounded, deep, alternate; petiole, short, thick, dark brown, mid-vein thinner near top of leaf; veins, alternate, thin, not many; color, dark brown, near mid-vein.

"What a mass of worthless matter in such instruction! Much of it so valueless that there is no pretense of reviewing it next day; it is even unnecessary for examinations. Here lies probably the greatest waste in our instruction. Where there is no careful selection of details, there is only an aggregation; chaos rules there, and despair is constant, because the field can never be covered.

"The teachers are not satisfied with such haphazard work, but it is difficult to bring about improvement. However, the difficulty lies not in method, but in the choice of matter, and I desire to make three recommendations in regard to the remedy.

"In the first place, the subject-matter in those branches that easily offer mere aggregations of facts, like history, geography,

and nature-study, should be brought under as few large headings as possible, just as a good lecturer is under obligations to present his thoughts under a few good points. . . .

"In the second place, those subtopics should be selected in each branch of study that are the best types of large groups, and that thus give strategic positions in the field. . . .

"In the third place, the leading questions that need to be answered under each type, or other topic, need to be clearly conceived in order to find a basis for selection of details. For instance, I have an extension class of 76 primary teachers—much above the average in ability—who agreed on 22 little points that they desired to teach on the cat, as a topic in nature-study. But until the principal questions that they had to answer in regard to the cat were known, to which these many facts might be the answers, their subject-matter was absolutely unorganized, and they were unprepared to give the instruction. Now our main interest in cats is as pets, and if we set out to learn (1) to what extent cats can provide for themselves, and therefore (2) to what extent, and how, we should take care of them as our pets, we shall cover all that is necessary about them. And when we desire only the answers to these problems, we are given a standard that allows the omission of the number of teeth, the color of the hair, the length of the tail, and forty other facts that might consume time; in short, that lets us know when we are done with the cat. So, if we set out to find out how grasshoppers sometimes prove injurious to man, and what means may be used to destroy them, we must discuss the food of the insect, his voracious appetite, his means of locomotion and quickness, his enemies (including parasites), his protection by mimicry, and his stages of development; but we shall have no time to consider whether or not he knows enough to go under cover when it rains, provided he can find cover, or the fact that he can eat apples, since he will never get many apples to eat anyway.

"Similarly, in geography, if we set out to learn what are the main industries that have sprung up in the Western States, with the causes, we shall need to consider the climate and topography, as the principal key to the situation, and then the mining, lumbering, agriculture, manufacturing, trade and manufacturing centers, etc., but we shall have no excuse for bounding all the States, learning each capital and locating various capes, small towns, insignifi-

cant mountains, etc. Above all, we shall be unwilling to drop into the state-treatment of our theme, which means a mere aggregation of facts, dry enough to cause a healthy child to long to play hookey, not for the pleasures anticipated, but for the pains escaped.

" These three recommendations together call for such an organization of subject-matter as has thus far been scarcely attempted. The thoroness customary—and probably justified—in the three R's and spelling, ignored unity of arrangement entirely; indeed, was independent of it. But the thoroness proper to other studies presupposes organization, and is based upon it. This kind of thoroness requires that much attention be directed to relative values of perspective, and to sequence, just as in a story.

" And such organization must be planned from the learner's point of view. Up to the present, however, the content of studies has been determined from the scientific point of view, so far as there was a point of view, and the love of ' truth for truth's sake ' has been so marked that one fact has seemed nearly as good as another; hence the curriculum of the common school reveals little selection or pedagogical arrangement. Studies like geography and nature-study are little more than conglomerate masses of fact, showing our educational development to be still in the barbarous stage. Studies in the high school and college are little better. History, for example, is no better organized there than in the grades, and probably not so well. To be sure, in some subjects, there is a more highly developed classification, but it is not the classification most appropriate to the learning mind, because the scientist's point of view is not that of the learner; it is rather that of the philosopher, who has digested his field and then arranges it logically, not psychologically."

In concluding his paper Dr. McMurry admits that his suggestions set a great task, one " for the most advanced and ablest students of education, who are as well posted in subject-matter as in the principles of education itself. Even these have more than a life problem in such a task." But this should not keep any teacher or director of nature-study in any of its phases from making improvements by beginning to apply some of the above principles of selection. Probably very few experts in nature-study will seriously oppose Dr. McMurry's declaration that there is much useless nature-study teaching, and that the time has now

come for beginning to eliminate by organizing the materials. Such definite criticisms are bound to be helpful, whether we accept them in full or not.

Another recent criticism of nature-study as now taught in the United States is by Professor Henry E. Amstrong, of London, who visited this country last year as a member of the Moseley Educational Commission. In the report of that commission (published in London, 1904) Professor Armstrong summarizes his observations on nature-study in many of our leading common schools by the statement that "The Nature-Study lessons I witnessed, when not specifically botanical or zoological and scientific in character, were eminently superficial and worthless." In another place Professor Armstrong writes concerning the nature-study work for rural schools: "There can be no doubt that a pioneer work of great importance is being done, on which it will be possible to build in the future. It is not possible now to discuss in any proper way the method of teaching adopted. I desire to say everything in its favor, feeling as I do that the object in view is all important; but I am satisfied that the work lacks depth and that those engaged in it are not yet aware of the extent to which it is possible to introduce exact method into such studies; they need to be more fully acquainted with the practice of scientific method and with the art of discovery. It would be more nearly correct to speak of the movement as one for the promotion of Nature-love rather than as Nature-Study. At present it involves far too little real study and concentration of purpose; which is unfortunate, as rural children particularly need training in exactness."

Taking this criticism as a whole, many American educators who are quite familiar with our schools have expressed the opinion that the sweeping criticism "eminently superficial and worthless" deserves fuller explanation and discussion. Professor Armstrong promises that when the pressure of his work allows he will write for THE NATURE-STUDY REVIEW a fuller discussion of nature-study as he has seen the teaching in the United States; and then we shall be able to consider whether we can get helpful suggestions from his criticisms.

AGRICULTURE IN SOUTHERN SCHOOLS

BY PROFESSOR C. W. BURKETT
North Carolina College of Agriculture and Mechanic Arts

It is never an easy task to introduce a new subject into the public-school curriculum. This is due in part to the want of training on the part of the teacher; to an already crowded course of study; and to a constant disinclination to change from the old way of doing things to the new, even if the latter is better. The teaching of agriculture in the public schools with us has gone the same way as other studies that have been added from time to time. However, there has been a strong public sentiment in favor of agriculture in the schools. This sentiment did not come at once, but it had been before the people for a long time, so when any concerted action was given results quickly followed.

The feeling is especially strong in the Southern States that agriculture shall be taught in the schools. This is evidenced by the fact that the legislatures of Virginia, Tennessee, North Carolina, South Carolina, Alabama, Georgia, and Louisiana have each put agriculture on their required list of studies to bear the same importance as reading, writing, arithmetic, etc. And this has not been brought about by lobbying in the interest of text-book publishers, nor because of the demand of colleges and teachers. It is the people's demand. Rural South sees the advantages that would follow if her people were trained somewhat along the lines they will take up in after life. She believes that it is just as important that her young men and women know something about the soil as about the stars; that they have some acquaintance with King Cotton as well as with King Richard; that they know about some of the laws concerned with plant and animal growth as well as the laws that had to do with the greatness of Greece and Rome. So the teaching of agriculture in the schools is a demand of the times. It is to make life fuller and richer by making the farm better, and the farm home more responsive. Culture will come just the same. Education, while perhaps more practical, will nevertheless be just as broad and effective.

Nor is agriculture to be taught in a desultory way. Teachers are carefully preparing themselves for the work. This is seen by the fact that during the past summer nearly six hundred teachers

elected agriculture and nature-study at the North Carolina College of Agriculture and Mechanic Arts. At the University of Tennessee summer school over two hundred elected agriculture and nature-study; and at the Hampton (Va.) Normal and Agricultural Institute over five hundred teachers studied the same. It may be said that the same number of teachers were students in agriculture at the various summer schools and teachers' institutes throughout the South.

The importance of agriculture as a required study is intensified by giving the study a regular place in the daily school program. A text-book is used; experiments are performed; tramps to brooks, fields, and farms are made; essays are written on agricultural subjects as a part of the regular work. Of course it will be seen that all this contributes to making the work both profitable and interesting to the pupil and teacher alike. While the work is new, the experiment now being made promises to be of great importance to the schools throughout the South. It is interesting parents in school work who have heretofore been uninterested in education. It is dignifying farm life, and it is destined to help the fields, and flocks, and herds of the South where the great wealth lies.

SCHOOL-GARDENS

[EDITORIAL NOTE.—School-gardens have in recent years become a prominent and valuable part of the nature-study movement, and hence it is within the province of this journal to consider them as a phase of nature-study. It is not planned to publish a long series of descriptions of gardens which are in all essentials similar, and there will be no attempt at imitating the elaborate illustrated and detailed reports which are often published principally for local distribution. On the contrary, we will select for publication those original suggestions which seem to be applicable to any school-garden, and which will tend to encourage the development of new gardens. But we will not aim entirely at the practical problem of making a garden which interests the pupils and their friends and looks attractive in photographs. So far as the mere practical side of gardening is concerned there are hundreds of successful school-gardens in the United States; but in general

little effort is being made towards making the gardens of greatest educational value, except in the line of manual training. This latter alone is undoubtedly worth all the effort and is a sufficient justification for making school-gardens in connection with elementary education; but gardens are such splendid concentrations of natural objects, especially the living, that they surely have the possibilities of great educational value in discipline other than manual and in information which has practical, intellectual, æsthetic, and moral bearings. It is here, rather than in the practical management, that we see the present problem concerning the school-garden movement; and suggestions for making gardens most efficient educationally will be welcomed.]

SCHOOL-GARDENS AT THE SCHOOL OF HORTICULTURE, HARTFORD, CONNECTICUT

BY H. D. HEMENWAY

Director of the School of Horticulture

The School of Horticulture was established in the year 1900 as one of the Handicraft Schools of Hartford by the Rev. Francis Goodwin. Mr. Goodwin is the founder and largely the supporter of the Handicraft Schools, for which he donated over one hundred acres of land in the northwestern part of the city of Hartford. School-garden work is only one of the subjects taught at the School of Horticulture, although it has become most widely known on account of the success attained in this line of work. Probably no school-gardens in the country are conducted on more simple, more systematic and at the same time more scientific principles than those at this school. Nevertheless, it is possible to get more good from a garden connected with the public schools because there all the work can be correlated with other branches of study.

The children come from the city in classes of about fifteen. They enter the class-room where each pupil receives a numbered note-book on which he writes his name and the name of the public school that he attends. In making application for a garden, the pupil gives his name, age, residence, parent's name and occupation, nationality, the public school he attends and the grade. On the

first page of the note-book the pupil marks his own attendance and keeps a weather report. The second page is reserved for a diagram of the garden. On the third page the lessons begin. They are copied from the blackboard or given from dictation in clear, concise language. Packages of seeds put up in coin envelopes, just enough of a kind for a row, are supplied the pupils, and they then pass with the instructor to the tool-room where each receives a numbered set of tools—a hoe, a rake, a line, and a weeder. With the note-books, seeds and tools the children pass through the observation plots to their gardens. An instructor is always present to show the young gardeners (many of whom

SCHOOL OF HORTICULTURE, HARTFORD, CONN.

SCHOOL GARDEN CLASS.

Garden No. ..... Began ..... 190..

Name, ... Age, ... years.

Descent, ...

Parent, ...

Occupation, ...

Residence, ...

School, ... Grade, ...

Principal, ...

	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER
Date,								
Attendance,								
Work,								
Note Book,								
Department,								

REMARKS.

CODE. E.—Excellent. G.—Good. F.—Fair. P.—Poor. I.—Present. A—Absent. L.—Late.

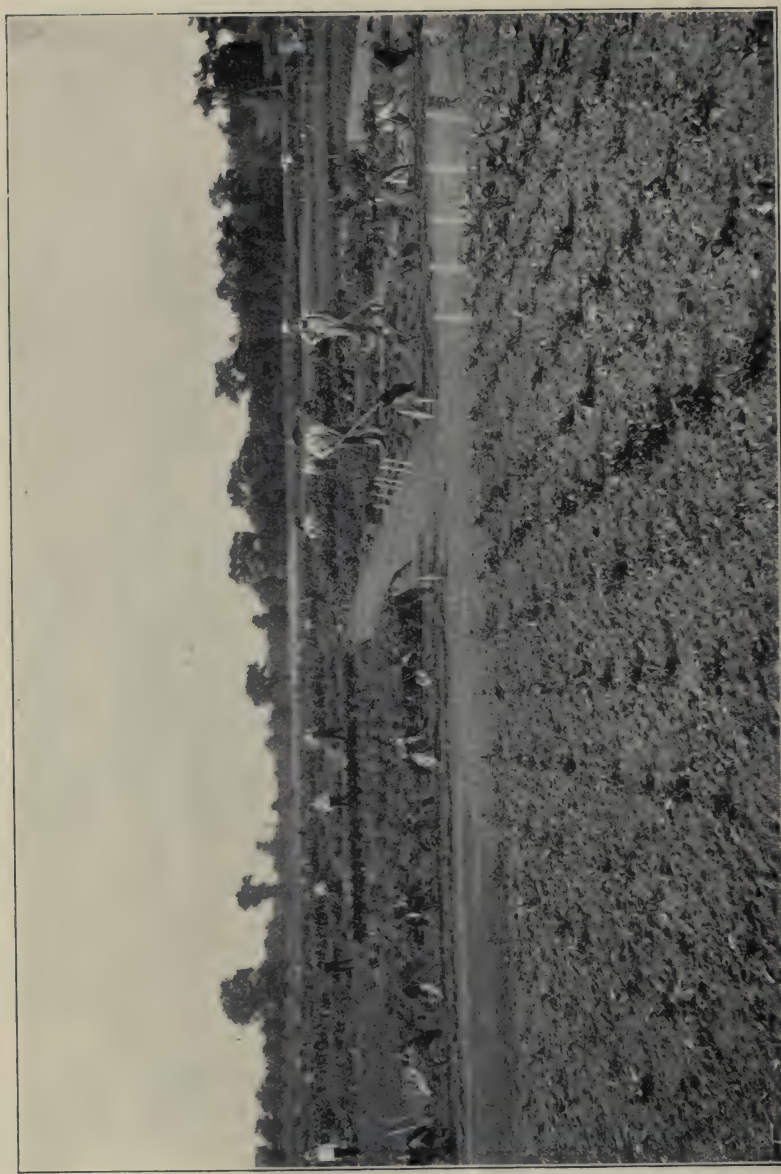
have never had a hoe or a rake in their hands before) how to carry out the instructions given in the class-room. As soon as the work is finished, each child takes his tools to the tool-room, cleans and hangs them in their proper places, returns the note-book to the class-room and goes home. In this way discipline is reduced to a minimum because the quicker pupils are not kept idly about while the slower ones finish their work. The girls' gardens are the same as the boys; but they come in separate classes.

All work about the individual gardens is done by the pupils, who become owners and have all the products of their toil. The third and fourth year pupils assist some in staking out their own gardens and selecting the crops they are to grow. The fourth year pupils make all their own selections and original diagrams. The individual gardens have gradually increased in size until now they are ten by thirty feet for beginners, ten by forty feet for second year pupils, ten by sixty feet for third year pupils, and ten by eighty feet for fourth year pupils. They are situated on the

west side of a long main walk ten feet in width. Paths five feet wide lead from this walk between the rows of gardens, and there are walks three feet wide between each garden. Corn is planted on the north end of each garden so that the wider walk takes the shadow. On the east side of the main walk are arranged observation plots in which are grown about one hundred herbaceous and annual flowers and one hundred and fifty different kinds of other plants, including all the cereals, market garden crops, fibre plants, many of the legumes, forage crops, medical and pot herbs.

The buildings at the Hartford School of Horticulture.

The garden courses begin with the fourth year pupils in January; the third year pupils in February; the second year pupils in March; and the first year pupils about the first of May, according to the season. The work taken up by the advanced pupils is making hot-beds; hot-bed mats of rye straw; glazing, painting and repairing sash; drawing original garden plans; various methods of grafting, and making the grafting wax, cord and cloth; physical analysis of soil; study of soils and plant foods; notes and practical work in taking cuttings, both hard and soft wood; pruning; spraying with insecticides and fungicides; spad-



"All work about the individual gardens is done by the pupils, who become owners."

ing; taking up and setting out trees and shrubs; care of grounds—lawns and walks; silk-worm culture; mixing soil; planting seeds; potting and re-potting plants in the greenhouse and transplanting them in the garden. The advanced boys grow all the greenhouse plants for all the boys' gardens. Each year the pupils get some advanced work and a review of the work they have already had.

The lessons are regularly once a week for each pupil. The time is so arranged that it does not interfere with public-school work in any way, lessons coming after school in spring and autumn. They continue every week during the summer. Pupils are permitted to come and work in their gardens at any time when the tools are not in use.

Seeds, tools, note-books, etc., are furnished by the school, but a tuition fee of five dollars for the first year, seven dollars for the second year, ten dollars for the third year, and twelve dollars for the fourth year is charged the pupils. This sum, however, need not keep any worthy boy from having a garden, for one hundred hours' work for the school pays any boy's tuition, and many boys pay in this way. Several have found that in so doing they have not only paid for their garden, but have also fitted themselves to take positions in the city. This past season several persons have applied to the school for boys to care for their gardens and lawns because the men they were hiring to do the work were unsatisfactory in that they did not know the difference between the weeds and plants. One of the second year pupils, so recommended by us, proved himself so satisfactory that the lady hiring him recommended him to several others until he had all his time engaged. At the end of the season his savings bank account was a great contrast to that of the boys in his school who had no garden and spent their time upon the street. But aside from the money value, the boy learned industry and acquired an interest in plants, which will mean much to him in future life.

The yield of the garden should exceed the price of the tuition paid. It varies, of course, according to the manner in which the boy cares for it. One third-year garden (ten by sixty feet) yielded as follows: thirteen and one-half quarts shell beans; ten quarts wax beans, six quarts lima beans; fifty beets; six cabbages; forty-four ears of corn; eighteen roots of celery; forty-two heads of lettuce; ten onions; fifty-eight quarts Swiss chard; six quarts peas; one peck potatoes; seventeen five-cent bunches of parsley;

three hundred and fifty-nine radishes; nine quarts spinach; forty-three summer squash; one hundred and thirty-five tomatoes; thirty-eight turnips; eleven quarts of Valentine beans; and for flowers: three hundred and twenty-five nasturtiums; one hundred and seventy-four pansies; thirty-five snap-dragons; one hundred and thirty-five stocks; and six hundred and ninety verbenas. At the regular market price the vegetables were worth over fifteen dollars, without taking into consideration the flowers at all. The crops are so arranged that after the fourth week in the garden there is something to take home after every lesson. Many of the boys leave some of their flowers in the gardens so as to make them more attractive; and these, of course, do not show on the total yields of the gardens.

As soon as the pupils have finished planting their gardens, one or more of the common weeds is studied at each lesson—roots, stem, leaves, and, if possible, the flowers and seeds. The pupils are taught the name of the plant and its uses (if it has any), and the best time and method of killing it. In the same manner the cereals, garden crops, and fibre plants are studied. The children are taken through the observation plots frequently, and the value of the crop, its importance in the United States, and the products and bi-products are explained to them. All observation plots, both of vegetables and flowers, are plainly labeled with the common names so that the children may become familiar with them. The Latin names are also put on most of the labels of the flower plots.

Insects are also studied and the children are taught how to treat the commoner ones as well as to know them in all of their stages of development. In 1904 more than one thousand silk-worms were grown. These were watched by all classes from the egg to the cocoon and the adult moth. The different stages of development were made use of in illustrating the different stages which some of the smaller insects pass through.

Besides the children's gardens, there are classes in school-garden work for adults. The advanced class begins in the early part of the winter and the students are those who have already taken one year's course in school-garden work, or teachers of the New Britain State Normal School, or teachers in Hartford public schools. This class studies the physical condition of the soil, plant foods, seeds, testing seeds, collecting seeds, germination, grafting of all kinds, silk culture, drafting school-garden plans,

history of the different crops, hot-beds, fungi, etc. Each individual has one garden, ten by thirty-five feet, to be cared for throughout the summer.

While a great many plants grown at the school are not very common, an effort is made to have all classes become perfectly familiar with our common forms which can come into the daily life of every pupil.

"The annual exhibit is for the young gardeners what the closing day was to the pupils in the old district schools."

The Civic Club of the city of Hartford has from the beginning been much interested in the school and offers twenty-five dollars in prizes, which are awarded in the autumn when the exhibit is held. Prizes are offered for the best kept gardens in each of the classes, the awards being made by judges who visit the gardens frequently during the summer. There are also prizes for the produce that is grown in the boy's garden, the variety, quality, and arrangement at the exhibit being considered in awarding the prizes. There is also a hoeing contest open to all boys, prizes

for each class, and a spading contest open only to the third and fourth year boys. The exhibit is for the young gardeners what the closing day was to the pupils in the old district schools. Parents, teachers and friends are all invited to be present. An effort is made by every gardener to have his garden in perfect condition, and the rivalry in arranging the produce on the tables is keen. The hoeing and spading contests show visitors something of what the boys have learned in the methods of handling tools, while the gardens and produce show what they have accomplished in applying these methods. There are also at the exhibit spinning wheels and a hand-loom in operation, and the different fibre plants grown at the school—jute, cotton, flax, ramie, and hemp—are all shown in their various stages of development and manufacture from the growing product to the finished cloth. This has been explained to the children; although this is the only practical demonstration that they have the opportunity to see. There are also exhibits of the handicraft courses as well as the school-gardens, which aid in making the school-garden exhibit not only very attractive but of educational value.

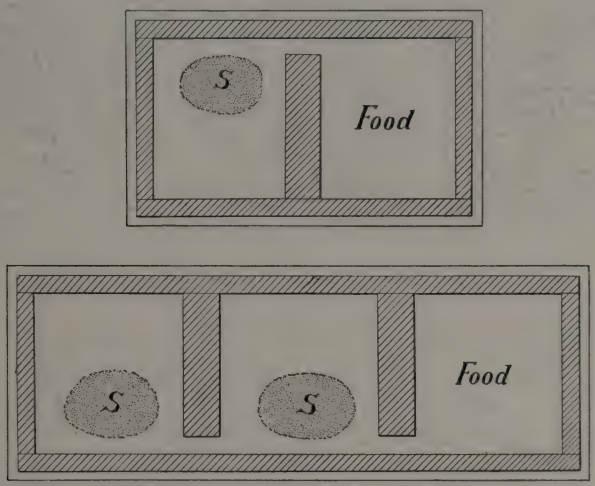
What is done at the School of Horticulture can be done in many schools. It may not be possible to have as large gardens, and often it will be necessary to secure land in the public parks or in vacant lots. The grafting work and potting can often be arranged in the basement or on a table in the schoolroom, and the "*window-garden*" is the teacher's greenhouse. In it can be grown all of the early vegetables and flowers started for the gardens outside, and greater interest and enthusiasm will develop if the children see the plants growing day by day. Of course, there must be an instructor who is equal to the task.

While we may not be able to make many farmers and gardeners, we may help to make much better men and women. It is hoped that we may check the flow of people to the city and turn some back again to the country. The school-garden creates a love for industry, a love for the country, for nature and things beautiful, and makes boys and girls stronger, more intelligent, nobler, truer men and women.

ANT–NESTS FOR THE SCHOOLROOM

Suggestions from a paper by Adele M. Fielde, in Biological Bulletin

The ants are, with perhaps the exception of bees, the most interesting insects which can easily be kept for daily observation, and teachers will welcome recent improvements in methods of keeping them in captivity under conditions which they may be easily observed whenever desired. Most important of improved methods are those recently described in *Biological Bulletin* (Vol. 7, No. 4, Sept., 1904), by Adele M. Field, of New York, who seems to have brought near to perfection the ant nests which she first described in 1900. She now has ants which have lived, without earth, for three years in health and contentment.



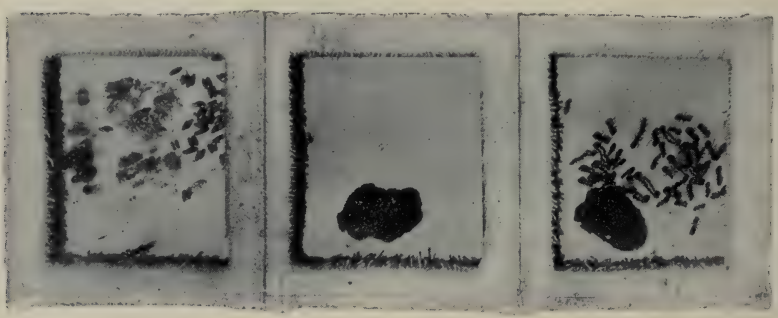
Floor plans of 2- and 3-room ant-nests. The oblique shading represents the walls and S the sponge for moisture.

The Fielde nests are made as follows: The foundation or floor of the nest is a pane of thick window glass (10 by 6 or 6 by 4 inches). This is laid on a sheet of thick, white blotting paper; but the paper is not fastened to the glass. Next, a wall is built up about one-fourth inch from the edge of the glass (see figure). This wall is made by cementing (with Diamond, Major's, or other crockery cement) to the floor plate four glass strips about one-half

inch wide and double thick, and then upon these cement four other strips so that the wall will be at least one-fourth inch high. Avoid interstices where ants might hide or escape.

The space enclosed by the glass wall is divided by one or two partitions double the width of the wall, but otherwise made the same way. The glass strips for these partitions are cut short so as to leave a passageway from room to room, and this passage is covered with a strip of thin celluloid or mica.

After cement is well dried, the edge of the floor plate and the outside of walls are covered with opaque cloth or paper, using some liquid glue. These edges may be painted with black enamel, but cloth is said to wear better.



In the Fielde nests ants have lived for three years.

There is a glass roof-pane for each room in the nest. The glass is thin; extends to the middle of the partition and to the outer edges of the walls on which it rests; prevents the exit of ants; and permits observation of their behavior. The glass may be without color, or it may be a red or orange tint (such as photographers use) that will partially exclude ultra-violet light. Ants perceive rays of light which are of short wave-length, and by use of a spectroscope, a glass roofing has been selected which renders the ants visible within the nest while it protects them from the light-rays which they instinctively shun. If such glass is used for roofing the nest, the ants will behave as if in darkness where they habitually live.

The glass roof-panes rest upon a cushion of Turkish toweling which is glued to the top of the wall of the nest. This allows ventilation and prevents the escape of the ants. In its simplest

form it may be made by cutting a piece of toweling the size of the base of the nest and then cut holes the size of the inside of the rooms of the nest (see accompanying half-tone).

An outer roofing of blotting-paper makes the interior of the nest wholly dark. The food-room should be light, as it represents the ant's outside world.

When any room in the nest requires cleaning, it is covered with transparent glass, and then the ants withdraw from it with their young into a dark room, which may in its turn be made light.

The food-room is dry, and in cool weather requires attention but once a fortnight. Sponge-cake merged in a little honey or molasses, banana, apple, mashed walnut, and the muscular parts and larvæ of insects are among the favorite edibles. Food should be constantly attainable in the nest, but it should be introduced in tiny morsels that it may not by decomposing vitiate the air.

Since moisture encourages the growth of molds, no water is put into the food-room. But ants drink often, and they require a humid atmosphere. All other rooms than that alloted to their food are made humid by laying a flake of sponge on the floor and keeping the sponge saturated with clean water dropped twice a week from a pipette. The sponges are kept clean by weekly washing and immersion in hot water. Sponges of fine tough texture render best service, as they offer no apertures where ants may conceal their eggs. The flake of sponge should be so thin as to permit the ants to pass between it and the glass roof-pane.

The completed nest is less than half an inch in its interior height, and does not exceed three-fourths of an inch in its exterior height. A low-power lens is easily focused upon the ants within the nest.

In order to stock a nest with an ant colony, wild nests are dug up and the ants captured are carried, along with some soil, in jars whose mouths are covered with gauze cloth. The ants and soil are then scattered over an " island " made by floating a board on water, or better, by grooving a channel around the edge of a thick board and filling this moat with water which temporarily confines the ants. A piece of glass covered by opaque paper is suspended slightly above the surface of the board. The ants soon gather their young underneath the darkened glass, and some of them may be easily scooped, without any soil, into the nest. Or a nest

may be placed on the " island " and the cover left open so that the ants may get into the darkened rooms.

Instead of the " island " above described, some collectors make, on a table, a stockade of dry plaster of Paris which, like water, confines the ants until they collect beneath the darkened glass.

In transporting the nest it is advisable to tie the covers with tapes or rubber bands. Miss Fielde has carried her nests on long railroad journeys, placing them on shelves in a portable wooden case.

These improved ant-nests are so simple in construction and make keeping the insects so easy that they deserve a trial in schools, and this review is made because it seems probable that we have here a valuable suggestion for nature-study work. At a later time we hope to present some suggestions as to studies of ants which may be made by pupils in the school.

BOOK REVIEWS

American Natural History. By W. T. Hornaday, Director of the New York Zoological Park. N. Y., Scribner's Sons. 1904. Pp. 449 (about 7 by 10 inches), illustrated. $3.50.

This new " foundation of useful knowledge of the higher animals of North America " supplies a long-felt want for a one-volume work devoted to the natural history of American vertebrate animals. With the exception of some interesting foreign types (e. g., the kangaroo) introduced simply to complete systematic surveys of groups, this is strictly a book of American backboned animals. One may examine the book in vain for descriptions of animals such as the lion, zebra, giraffe, tiger, and elephant, and other familiar representatives of the Old World; but the woodchuck, bison, raccoon, opossum, moose, and the others of the long list of peculiar American types are in prominence, and concerning them there is the kind of information which the general reader requires of a reference work in natural history.

This book is intended to give the teacher and general reader that information which will fill the " wide and deep chasm " between the scientific " zoology " of the colleges and universities and the nature-study books of the grammar grades. We infer that

the author would limit high-school teaching to natural history arranged on a foundation of classification, for he holds that "System is the only master-key by which the doors of Animate Nature can be unlocked"—a statement with which a very large number of teachers will decidedly disagree.

The book begins with the highest of the mammals and ends with the lowest of the fishes, an order of study which the author considers most interesting to beginners. The illustrations are excellent and very attractive. There are 227 original drawings, 116 photographs, and many maps and charts. By special arrangement with the publishers we are able to reprint in an advertising page a sample illustration, one which is also full of interest apart from its connection with the book.

Summarizing its good points, the reviewer is led to say that the "American Natural History" is, in all essential respects, an excellent and intensely interesting book; and it will surely fill an important place in private, public and school libraries. It will long be the popular reading and reference book on American animals; and it deserves a reign of popularity such as in the last half of the last century was given the books by the late J. G. Wood, the English naturalist, who did more than any other to popularize animal natural history in Britain and wherever the English language is read. M. A. B.

How to Know the Butterflies. By John Henry Comstock and Anna Botsford Comstock. N. Y., Appleton & Co. 1904. Pp. 311 (5¼ by 8 in.), 45 colored plates and 50 figures in text. $2.25 net.

This addition to the already long list of books on butterflies will be welcomed because it aims primarily to help the beginner in the study of these insects. This is done by means of excellent illustrations of common butterflies without a confusing array of figures of foreign species, by giving brief but sufficiently full descriptions, and by recording only the more important facts about the life-histories.

Part I of the book is a general account of relationships, structure, metamorphosis, the life of butterflies, and methods of collecting. Part II deals with the classification of butterflies of ten prominent families and their leading sub-divisions. There are tables without technical terminology so that the beginner's way to the name of a family is a quite easy one; and the descriptions

and illustrations in the chapters devoted to families will in most cases make the determination of the species a pleasurable task. The forty-five full-page plates are so life-like that even an elementary pupil could easily identify most common butterflies.

While the book is intended for use in the eastern half of the United States, the wide range of many species and the general chapters will make the book valuable in the far western states.

The book seems to the reviewer to be just what is needed by the one who studies entomology for recreation and by the teacher who conducts lessons on butterflies in connection with nature-study of the schools. M. A. B.

NOTES ON RECENT PAMPHLETS AND MAGAZINE ARTICLES

Department of Agriculture Publications. Of interest to teachers of nature-study, particularly to those who deal with the agricultural phase, are many pamphlets issued by the U. S. Department of Agriculture during the year 1904. The popular series of Farmers' Bulletins (free upon application to the Secretary of Agriculture, Washington, D. C.) has been extended by adding Numbers 185 to 205. Of these the following are of most general interest: No. 185, "Beautifying the Home Grounds," gives useful suggestions regarding the selection, planting, and cultivation of trees, shrubs, vines and herbaceous plants suitable for home grounds. No. 188, "Weeds Used in Medicine," contains interesting information, with illustrations, concerning about 25 of our very common weeds. No. 191, "The Cotton Bollworm," will interest teachers in the South. No. 195, "Annual Flowering Plants," deals with the cultivation and uses of a large number of easily cultivated annuals. Its primary purpose is to aid in the home-gardening of the farmer, but it is of great value to all who are interested in school-gardens. No. 196, "Usefulness of the American Toad," deals with the life-history, habits, food, enemies, and economic relations of this animal which is so interesting to nature-study classes. No. 198, "Strawberries," deals with the story of the origin, the varieties, and the cultivation of the garden strawberry. No. 199 is on "Corn Growing." No. 200 deals with 'Turkeys: Standard Breeds and Management."

In addition to these new bulletins many earlier ones are again available as reprints.

Pamphlets on Birds. The following pamphlets have been reprinted for free distribution by the U. S. Department of Agriculture: "Meadow Lark and Baltimore Oriole" and "Four Common Birds" (1895 Yearbook), "Blue Jay" (1896 Yearbook), "Food of Nestling Birds" (1900), "Economic Value of the Bobwhite" (1903).

Hampton Nature-Study Leaflets. This useful series of leaflets has during this year been extended by the following: No. 13, "Arbor Day Suggestions," by Rossa B. Cooley; No. 14, "Winged Pollen Carriers," by Mrs. Comstock; and No. 15, "School Gardening." Also, for children there is a leaflet on "How to know the trees by their bark," by Julia Ellen Rogers. All these leaflets are well illustrated. It is announced that, owing to a decrease of funds, the free distribution of leaflets must cease and they will be sold at 25 cents per dozen to Southern teachers and 50 cents to subscribers elsewhere.

Illinois Leaflets on Agriculture. No. 41 (Jan. 1904) in the series of agricultural leaflets for supplementary reading written by the professors of the College of Agriculture, University of Illinois, discusses in simple language the improvement of animals and plants by careful selection. This, like the earlier leaflets, consists of eight pages, 5½ x 7 inches. The leaflets may be obtained in lots of ten or more, assorted as desired, at one cent a copy, from the publisher, C. M. Parker, Taylorville, Ill.

Massachusetts Nature Leaflets. The State Board of Agriculture has during 1904 published the following new leaflets: No. 20, "Massachusetts Weeds," and No. 21, "Potato Rots," by Dr. Geo. E. Stone; Nos. 22–25, by C. H. Forbush, contain hints for outdoor bird study—No. 22, "How to Identify Birds," No. 23, "How to find Birds," No. 24, "How to Approach Birds," and No. 25, "How to Attract Birds."

BOOKS RECEIVED

(Many of those published during 1904 will receive more extended notice later)

EDUCATIONAL

Nature Study with Common Things. By Marion H. Carter. N. Y., American Book Co. 1904. Pp. 150. 60 cents.

How Nature Study Should be Taught. By E. F. Bigelow. N. Y., Hinds, Noble & Eldredge. 1904. Pp. 203, illustrated. $1.00.

Nature-Study Lessons. By M. W. Crawford, William Scott, John Dearness, and W. H. Elliott. Introduction by E. F. Bigelow. N. Y., Hinds, Noble & Eldredge. 1904. Pp. 194. 75 cents.

The Teaching of Biology in the Secondary School. By F. E. Lloyd (Botany) and M. A. Bigelow (Zoology). N. Y., Longmans, Green & Co. 1904. Pp. 490. $1.50. (Both parts discuss nature-study in its bearings on high-school biology. These sections on nature-study will be reviewed later.)

Nature Study and the Child. By C. B. Scott. Boston, D. C. Heath & Co. 1901. Pp. 618. $1.50. (A discussion of aids and principles. Also contains lesson plans.)

GARDENING AND AGRICULTURE

First Principles of Agriculture. By E. S. Goff & D. D. Mayne. N. Y., American Book Co. 1904. Pp. 248, illustrated. 80 cents.

The Garden Diary. By Rose Kingsley. N. Y., Pott & Co. 1904. 75 cents. (A page for each day of the year is headed with a poetical selection and the remainder is left blank for "Garden and Nature Notes.")

ANIMAL NATURAL HISTORY

American Natural History. By W. T. Hornaday. N. Y., Scribner's Sons. 1904. (Reviewed in this issue.)

Our Big Game. By D. W. Huntington. N. Y., Scribner's Sons. 1904. Pp. 347, illustrated. $2.00 net.

BOOKS FOR PUPILS

Animal Stories. Retold from St. Nicholas. Edited by Miss M. H. Carter. Vol. I, About Animals. Vol. II, Cat Stories. N. Y., Century Co. (Four more volumes are in press.)

Monarch, the Big Bear. By Ernest Thompson Seton. N. Y., Scribner's Sons. 1904. Pp. 214, illustrated.

The Tree-Dwellers, and **The Early Cave Men.** By Katherine Dopp. Chicago, Rand, McNally. (These books will be reviewed in connection with an article on the relation of primitive-life studies to nature-study.)

Nature's Byways. By Nellie W. Ford. Boston, Silver, Burdett & Co. Eighth edition, 1903. 40 cents. (A reader for primary grades.)

Outlines in Nature Study and History. By Annie G. Engell. Boston, Silver, Burdett & Co. 1900. Pp. 165. 48 cents. (Lesson plans for the primary school.)

Bird Day. How to Prepare for it. By C. A. Babcock. Boston, Silver, Burdett & Co. 1901. Pp. 95. 50 cents. (An introduction to the study of birds.)

Our Birds and Their Nestlings. By M. C. Walker. N. Y., American Book Co. 1904. Pp. 208, illustrated. 60 cents.

GUIDE TO PERIODICAL LITERATURE

A BIBLIOGRAPHY OF THE LEADING MAGAZINE ARTICLES OF INTEREST IN CONNECTION WITH NATURE-STUDY

JANUARY TO SEPTEMBER, 1904

ARRANGED BY ADA WATTERSON

Tutor in Biology, Teachers College, Columbia University

[EDITORIAL NOTE.—This first installment of an index to the periodical literature relating to nature-study begins the record of literature which appeared in the first eight months of the year 1904; and if space in the second number of this journal allows, there will be added to the list below the important titles under the following headings: "Natural history of plants and animals," "Physical Nature-Study," "Geographical Nature-Study," and "Agricultural Nature-Study."

It has not been attempted to make a complete bibliography, but rather to select those articles which appear to be most important and accessible in most public libraries. In the case of periodicals designed for local circulation, only articles of exceptional merit will be catalogued.

The figures with black-face indicate the volume and those following the : refer to the pages. The abbreviations of journal titles are those used in the general indexes to be found in libraries.

Readers are requested to inform the compiler concerning any important omissions.]

1. EDUCATIONAL AND GENERAL DISCUSSIONS OF NATURE-STUDY

Bardwell, D. L. Nature-study. New York Teachers' Monographs, **6**: 6–11. June, 1904. (This number also contains outlines, by various authors, for nature-study in the different grades.)

Bigelow, M. A. Outlines of work in nature-study in Horace Mann School, in "The curriculum of the elementary school." Teachers College Record, **5**: 35. March, 1904.

Broadhurst, Jean. Nature-study as a training for life. Plant World, **7**: 87–93. April, 1904.

Burroughs, John. Literary treatment of nature. Atlantic, **94**: 38–43. July, 1904.

Burroughs, Jöhn. On humanizing the animals. Century, **67**: 773–80. March, 1904.

Burroughs, John. True test of good nature literature. (Introduction to new edition of Nature Library.) Country Life in America, **6**: 51. May, 1904.

Chapman, F. M. The case of W. J. Long. Science, **19**: 387. March 4, 1904.

Davis, W. H. Natural and unnatural history. Science, **19**: 667–75. April 22, 1904. (Criticism of W. J. Long and other writers.)

Eppens, E. H. Nature-study à la mode—a protest. Critic, **45**: 149. August, 1904. (Protest against modern scientific methods of studying nature.)

Ganong, W. F. The writings of W. J. Long. Science, **19**: 623–26. April 15, 1904.

Gilmore, Gertrude. The functions of nature-study and what it can do as a preparation for high-school biology. School Science, **4**: 136–38. June, 1904.

Guillet, Cephas. A glimpse at a nature school. Ped. Sem., **9**: 91–99. March, 1904. (Curriculum based on a study of physiography.)

Hoke, G. W. The centre of interest in nature-study. Ohio Educ. Monthly, **53**: 63–65. Feb., 1904.

Latter, O. H. Nature-study. School World (Eng.), **6**: 108–9. March, 1904. (Value in correlation of studies.)

Long, W. J. Science, nature and criticism. Science, **19**: 760–767. May 13, 1904. (Reply to critics.)

McMurry, F. M. Advisable omissions from the elementary curriculum and the basis for them. Educ. Rev., **27**: 478–494. May, 1904.

Ranger, W. E. Nature-study movement. Education, **24**: 501–3. April, 1904.

Sharp, Dallas L. Our uplift through outdoor life. World's Work, **8**: 5043. July, 1904.

Spectator. School flower show. Outlook, **77**: 211. May 28, 1904.

Titchener, E. B. Nature-study. Amer. Jour. of Educ., **37**: 333–4. May, 1904. (Protest against "scientific nature-study" in the kindergarten.)

Ward, H. Marshall. Nature-study. School World (Eng.), **6**: 205–8. June, 1904.

Wheeler, Wm. M. Woodcock surgery. Science, **19**: 347. Feb. 26, 1904. (Criticism of W. J. Long.)

Zueblin, Chas. The return to nature. Chaut., **39**: 257–66. July, 1904.

QUESTIONS AND ANSWERS

This department will be devoted principally to the many little practical problems which are of interest to teachers of nature-study; and all readers are invited to use this column freely. Questions should be sent to the office of the managing editor. Some will be answered by members of the editorial board, while others must be referred to readers for answers in later issues. But in all cases the answers published are subject to discussion, correction, or addition by readers. We hope to have such supplementary answers within a month after the appearance of the first answer.

The announcement of this department in the prospectus of this journal has already called forth the following questions:

Question 1. Books on Trees. "Kindly give a list of popular books dealing with trees." W. N., Chicago.

Keeler's "Our Native Trees" (Scribners, N. Y. 1900. $2.00). Matthew's "Familiar trees and their Leaves" (Appleton, N. Y. New ed. 1903. 200 ill. $1.75). Lounsberry's "Guide to the Trees" (Stokes, N. Y. 1900. $2.50). Newhall's "Trees of Northeastern America" (Putnam, N. Y. 1890. $2.50). Rogers' "Among Green Trees: a guide to acquaintance with familiar trees" (Mumford, Chicago. 1902. $3.00). Huntington's "Studies of Trees in Winter" (Knight, Boston. 1902. $2.25).

Question 2. Classification of Birds. "To what extent should classification of birds be presented in the bird-study of a fifth or sixth grade?"

Referred to readers for answer.

Question 3. School-Garden for Rural Schools. "How should a rural school-garden be conducted so as to interest the pupils? It seems to me that the manual work involved in making gardens is such a familiar experience to country children that they will have little of the interest which novelty gives to the city children." F. H., Toledo, Ohio.

Referred to readers who may have had experience.

DISCUSSION AND CORRESPONDENCE

[EDITORIAL NOTE.—All articles in THE REVIEW are open to discussion, and readers are invited to send their contributions to this department as soon as possible after the publication of the paper to which reference is made. The editors must reserve the right to select and abridge if space is limited, and to modify criticisms which tend to be so personal or acrimonious as not to be helpful. The weak points of the nature-study movement deserve free discussion, but in the spirit and form of good friendship for all persons who may represent opposing views.]

NEWS NOTES

[The help of all readers is needed in keeping THE REVIEW in touch with local developments of nature-study. Information regarding important changes in local movements, notes or manuscripts of papers read at local conventions, literature designed primarily for local circulation—these suggest the nature of information which will be useful to the editorial managers, especially to the writer of this page devoted to "News Notes."]

Nature-Study Libraries. Hampton Institute has begun a system of traveling nature-study libraries for Southern teachers. A set of twelve books is loaned for a school term at a rental of fifty cents.

New Nature-Study Society. North Carolina teachers of nature-study have recently completed the organization of a state association, The N. C. Nature-Study Society. The officers are: The State Superintendent of Schools, Dr. Joyner, President, and Professor Stevens, of the Agricultural College, Secretary. A board of advisers, composed of specialists in each branch of science, will answer questions by teachers; local branches will be formed in schools; and a series of leaflets will be published.

Migrating Birds. Of interest to students of birds, and, indeed, to all who are interested in birds, is the report that a law intended to prevent the killing of certain species of birds will probably be passed in Mexico. This will certainly protect some of our migrants which are wantonly destroyed in their winter homes.

Death of Dr. Muldrew. We regret to announce the death of Dr. W. H. Muldrew, Dean of Macdonald Institute, the new Canadian school of nature-study which is referred to elsewhere in this issue. He was one of the collaborators named in the prospectus of this journal.

Untrimmed Copies. Subscribers who prefer their copies of THE REVIEW with pages uncut should notify the managing editor before No. 2 is published March 20th.

NATURE-STUDY COLLECTIONS

OR thirty years and over we have been studying the needs of teachers in all grades and branches of natural history. We have all along contended that the success of their work, whether in primary school or university, depended largely upon their putting *concrete actual objects* into the hands of their pupils—a contention which the present nature-study movement has confirmed. Our best efforts have therefore been directed unremittingly toward enabling teachers everywhere to secure and use the kind of material they most needed. In this we have not worked blindly along theoretical lines, but have always had *teachers of practical experience* in our service. The results are embodied in our series of school collections, the number and variety of which enables us to meet the most diverse needs and conditions. It is not our purpose to attempt a full account or even a list of these collections in this limited space. Our catalogues and circulars describe them fully and will be sent upon request. We merely ask whether you would not find some of the following things useful in your work. Do not say that you cannot afford them, or that your school is too small, or the pupils too young to appreciate them, but let us tell you more about them by letter, and perhaps your obstacles will disappear. Do you not need—

A good collection of *minerals*, good in quality, good in labelling and mounting, broad in scope, characteristic and representative? Especially if it illustrated some standard textbook—e. g., Dana's?

Some crystal models, of the six systems?

A good collection of *rocks*, either *lithological* or *stratigraphical*, or best of all *genetic*, thus illustrating clearly how rocks are *made*? Would not, for example, a complete series of New York State rocks from typical localities, revised and up-to-date, be a grand thing for your work?

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Anatomical models or human skeletons for class use? Or anything else in the line of natural history?

If you would know more about these, send us your address on the back of a postal card, with the words "Nature-Study,"—we will know what it means, and it will pay you to be on our mailing list. We are here to help you.

Remember that we are the pioneers in this work and that we have the largest stock in the country to select from. Remember also that we have not only *planned the collections for you*, but have published *descriptive catalogues* to accompany them that are virtually pocket text-books of the subject, and are actually used as such in many places!

Ward's Natural Science Establishment, 76-104 College Ave., Rochester, N.Y.

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PART IV.—*No. 10 *The Magnolias* and related trees. *No. 11. *The Horse Chestnuts* and allies. No 12. *The Maples.* (Printed in advance.)

For further information address the author, publisher and proprietor.

GRACEANNA LEWIS, Media, Pennsylvania

"Do Elk Shed Their Antlers?"

An answer from the New York Zoölogical Park.

1. March 21
2. April 8.
3. April 30.
4. May 15.

From "The American Natural History."

(*See Review in this Journal.*)

Published by

CHARLES SCRIBNER'S SONS, New York

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THE NATURE LIBRARY

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THE NATURE LIBRARY is the only group of books on natural history that gives scientifically accurate information in simple, narrative style, and in a way that makes it equally available for studious reference or casual entertainment.

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This is the first time a systematic effort has been made to bring the reader into an intimate knowledge, free from fanciful invention, of the home life of our brethren of the lower world. The difficulties of photographing wild animals in their native environments, birds on their nests, and timid creatures in their hidings, are sometimes insuperable; but the success that rewarded the fatigues and hardships of the makers of THE NATURE LIBRARY, and which is attested throughout the pages of the ten beautiful volumes, makes this set of books not not only unrivaled, but absolutely unique in the field.

Besides the 450 half-tones from photographs taken especially for this work in all regions of the country, and the 300 extraordinary and remarkably lifelike color plates, there are about 1,500 text cuts, such as are usually regarded as all-sufficient illustrations of theses on natural history.

In the actual value of the pictorial matter, the purchaser gets more than the price of the ten volumes: and yet the information, charmingly, familiarly presented in the 4,000 pages, is a treasury from which the most careless reader may extract a sort of riches he would not willingly lose again.

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COUNTRY LIFE IN AMERICA · DOUBLEDAY PAGE & CO · 133-135 & 137 E. 16TH ST. NEW YORK · THE WORLD'S WORK

(*Continued from the second cover page.*)

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THE NATURE-STUDY REVIEW

Vol. 1, No. 2 March, 1905

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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THE NATURE-STUDY REVIEW

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A JOURNAL FOR TEACHERS

The success of THE REVIEW must depend upon its usefulness to teachers who are engaged in putting to practical test the latest ideas concerning the teaching of nature-study. For this reason the editors want to give particular attention to the practical side of the teacher's work, and suggestions from any source will be gratefully received and carefully considered.

MONTHLY PUBLICATION

Numerous friends of THE REVIEW point out the importance of monthly publication during the school year, September to June inclusive. The desirability of this has been recognized from the very beginning of the plans for the journal; but the advice of persons of experience has been that a bi-monthly should be tried the first year, and if that is well supported then change from six to eight or nine issues per year. The outlook for monthly publication next year is now hopeful. But we must have many more subscribers, and we ask present subscribers to co-operate with us in reaching teachers who have not yet learned that this special journal is being published. Please send us the names of those who may be interested, and mention THE REVIEW to your friends.

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PLANS FOR FUTURE NUMBERS

As stated in the prospectus and as illustrated in this and the preceding number, it will be the aim to make each issue present a wide range of material dealing with all phases of nature-study. Beginning in the next number, a series of articles will discuss the relations of the various phases of nature-study—biological, physical, geographical, agricultural—to each other and to related subjects in the elementary-school curriculum. Papers in these lines have been promised by collaborators and others. The following papers are expected to introduce the subjects for discussion: Professor Dodge, of Teachers College, Columbia University, and Dr. Fairbanks, of the Editorial Committee, on "Geography and its relation to Nature-Study"; Professor W. S. Hall, of Northwestern University, and M. A. Bigelow, on "Physiology and its relation to Nature-Study"; Principal Baldwin, of Hyannis (Mass.) State Normal, on "Nature-Study and Manual Training"; Dr. Carrington, State Superintendent of Schools of Missouri, on "Agriculture and Nature-Study," and other papers on this subject by Professors Bailey, Burkett, Hays, Stevens, and Mrs. Comstock; Dr. Katherine Dopp, of Chicago, on "Nature-Study and Primitive-Life Studies"; and we hope to have papers on "Nature-Study and Elementary Art."

Many papers outside of the above series are in preparation; we have space to mention only a few: Mrs. Comstock, on "Attitude of Teachers in Teaching about Life and Death," and on "Books in Nature-Study"; Professor Hodge, on "The Human Interest in Nature-Study" and "Bird Studies"; Professor Bessey, on "Nature-Study as it was taught thirty years ago"; Professor Charles, of De Kalb, Ill., on "The Spirit of Nature-Study" and "The Nature Calendar"; Dr. E. F. Bigelow, of *St. Nicholas*, on various phases of out-of-door nature-study and practical studies with plants and animals; Professor Woodhull, on "Lessons in Physical Nature-Study"; Professor Croswell, of Los Angeles, on "Why some School-Gardens are Failures"; Miss A. Blood, of New York City, on "Difficulties of Nature-Study in City Schools"; Miss Gallup, of the Children's Museum, Brooklyn, on the work of that institution as suggesting plans for school collections; Miss Laura Underhill, of Horace Mann School, New York City, on "Bird Study in a Fifth Grade"; a series of illustrated papers on "School-Gardens"; another on "Lesson Plans" by several writers; and "Correlation between Physical and Biological Nature-Study" by M. A. Bigelow. In addition to these papers, we have promises from a large number of educators and men of science who have contributed to scientific education that their future addresses and other papers bearing on nature-study will be contributed to THE REVIEW.

We have suggested only the leading plans for the near future. It must be obvious that THE REVIEW will be indispensable to all who are interested in nature-study and the elementary sciences.

Since the above was set in type many voluntary suggestions and answers to correspondence have more than doubled the list of strong and interesting papers which will be published as rapidly as space permits.

THE

NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

VOL. I MARCH, 1905 No. 2

EDUCATIONAL VALUES AND AIMS OF NATURE-STUDY

A SYMPOSIUM BY S. COULTER, H. W. FAIRBANKS and M. A. BIGELOW

[EDITORIAL NOTE.—The discussion of the relations of nature-study and natural science opened by the symposium in No. 1 of this journal will doubtless be added to in later papers with other titles or by voluntary contributions to the pages devoted to "Discussions and Correspondence." So far as the discussions already published are concerned, it appears that the writers are practically agreed that: (1) nature-study and natural science, viewed from the standpoint of education, should be regarded as decidedly different in that true nature-study lacks the characteristic organization of science; (2) nature-study so distinguished from science is the proper work of the elementary and ungraded schools; and (3) nature-study should be understood as dealing with all phases of nature, physical as well as biological.

But although it is advocated that nature-study should be without strict scientific organization, there are many suggestions in the first symposium that the writers are looking for some satisfactory educational organization for nature-study. In search of such organization we naturally inquire first into the educational values of our subject and from these formulate the aims or guiding principles for the teaching. Here we are face to face with another fundamental problem; and, following the plan of the earlier symposium, the consideration of the questions involved is from the points of view of several writers. Several contributions to this symposium arrived too late for this issue and will be published later.]

I

BY PROFESSOR STANLEY COULTER
Purdue University

It is conceded, in view of the already crowded curricula of the schools and the excessive work laid upon the teachers, that no new subject should be introduced unless it is clearly shown to be necessary to secure the symmetrical intellectual development of

the child. If nature-study fails to aid in bringing about this result, it has no position in the schools which is at all defensible. It is essential, therefore, that there should be a clear-cut conception of the significance of the subject from this viewpoint. Its peculiar function is to develop the perceptive powers, and through this development bring the child into an intimate and sympathetic relationship with his surroundings. This central thought, the real educational purpose of nature-study, has too often been lost in the effort to make the subject the vehicle for carrying information bearing upon an almost endless variety of natural phenomena. In no other subject, perhaps, is there such need to keep constantly in mind the real end in view; to recognize the fact that it is not necessary to know plants and animals, but that it is through these to develop the perceptive powers so as to bring the child into a broader, a closer and a more sympathetic contact with the world about him.

If this view of the function of nature-study is correct, several conclusions necessarily follow. One of these bears upon the amount of work, which as a rule has been and is far too great. Indeed from any viewpoint the most cursory consideration shows this to be true when the youth of the child, the limitations of time, the other school work, and the over-burdened teacher are taken into account. The amount of work must be adapted to the capacity of the average child under the average conditions and this adaptation can be brought about in most cases only by largely reducing the amount of required or suggested work.

A second conclusion bears upon the material suitable for nature work. If the work be reduced in amount, there are manifold and patent reasons why the work touching plants and animals should be retained, the reduction therefore being brought about by the dropping of certain other subjects. This is certainly true for the earlier school years, whatever may be said in favor of different and more varied material for the advanced grades. Nothing appeals so strongly to the young child as life, and when life is associated with color and movement the appeal is all but irresistible. Changes in temperature, the formation of soils, the effects of erosion, and a host of other phenomena of great interest and value make no such appeal, do not enter so apparently or directly into the child life and can be left with safety until a later school period. The only objection to such a reduction of

work and a confining of the material in large measure to plants and animals will be found to have its origin in the belief that nature-study is a device for imparting information rather than a means for developing power.

A further conclusion is, that in presentation there must be a close adaptation to the intellectual development of the child, the methods employed emphasizing the work of the child and very much reducing the importance of those ordinary bureaus of information, the teacher and the book. Briefly stated nature-study has for its purposes the development, or at least the keeping functional, of certain powers of the child; not to give the teacher an additional opportunity for talking or as a means for the exploitation of books. The methods should be in every case such as to give the child this training.

Still another conclusion, if this view be correct, and one of great importance, is that the work of the various grades must be more closely related and that the work of each grade must have underlying it some definite pedagogic purpose. The fragmentary and illogical courses now offered under the head of nature-study show how little real thought has been given to this phase of the subject. The vast amount and range of suggested work merely serve to emphasize the conclusion that much may be done to make nature-study an efficient working tool in the schools by arranging a logically progressive scheme of study for each grade. The work as outlined for each year should have some definite intellectual end in view, and this should be directly connected with the purpose of the work in the year preceding and following. In the absence of such carefully wrought-out courses the work in nature-study must of necessity be fragmentary and unsatisfactory. At some future time it is the hope of the writer to present briefly a discussion of various intellectual centers about which the work of the grades may be grouped.

To summarize very briefly, the materials of nature-study are incidental, its intellectual purpose is the supreme thing. If it becomes an efficient means of securing a symmetrical intellectual development, there must exist a definite conception of its functions and limitations. The amount of work presented must be much reduced and the method of presentation carefully adapted to the child's mental development. Direct observation of nature must take the place of much time now taken by the teacher, and the

results of these observations must replace much that is now given in readings from the multitudinous so-called "nature-books." All of which means that we have no better tool for the development of the perceptive powers and bringing the child into sympathetic relations with his surroundings than nature-study, when it is *nature-study* pure and undefiled. Where it is not, it had much better be dropped from the course.

II

BY HAROLD W. FAIRBANKS, Ph.D.

Berkeley, Cal.

Nature-study has developed in our schools as a result of impulses from several different directions. On the one hand, we can trace its beginnings through object teaching to Pestalozzi and other educational leaders of the still more distant past, all voicing the feeling that the child's education should deal more with things and less with books. From another side has come the growing influence of science in the university and high school also emphasizing the importance of contact with nature.

While object teaching was formal and too often developed into a lifeless talk about isolated objects, the scientific notions which slowly filtered down into the elementary school frequently brought with them methods and aims not adapted to the building up of immature minds.

These two chief sources of inspiration in the nature-study movement differ very materially in their influence so that there has arisen two ways, broadly speaking, of looking at the subject. With one school of teachers the training and culturing of the mental powers is held to be the chief aim; with the others, the acquirement of exact and systematized knowledge.

The real differences, however, among those teachers who have given the subject thoughtful attention are probably in most cases not as great as they sometimes appear; and I can not believe that we are hopelessly adrift, but that there must be some unifying principle underlying all the diverse ideas, not only as to what is really meant by nature-study, but as to what its aims and values should be. If this principle upon which we can all unite can be brought into clearer light, it will go far toward placing nature-study upon a rational basis.

We can all agree that nature-study should deal with nature at first hand, should deal with the actual phenomena open to the child's observation. This much accepted, we have the foundation for another step involving the content of the subject. In no two localities are the home surroundings and the opportunities for first-hand contact with nature the same. One school is in a valley in an agricultural district; another is in the mountains where the leading industries are connected with mining. One school may be near the ocean with all its wealth of marine life, while another may be far from any large body of water. Spring plants may be growing up in one place while in another the ground is still covered with snow. Hence what is at hand for the children of one place can not always be personally investigated by those of another. It is unreasonable then to attempt to formulate any uniform course of study for all parts of the country.

In nature-study it matters little the number of facts acquired so long as the pupil is taught to see, think, and form conclusions of his own; to feel at home in the world and that he is a part of it. The inspiration of the teacher counts for much, and it is far better to cover only a part of the phenomena open to study, taking up those that he is particularly interested in, than to run over the whole field in a formal and lifeless manner.

Nature-study should not be an introduction to any particular occupation, such as agriculture or the workshop, nor should it be given for the purpose of an introduction to the science studies of later years. That it really does aid in agriculture, and in the shop, and that it does form a basis for science is nevertheless true. Nature-study has its own direct ends to accomplish—ends which are not trifling and insignificant, but of the highest value.

The aim of nature-study should be the putting of the child into harmony with his environment, into sympathetic and intelligent relationship with the factors of his surroundings, both organic and inorganic. He does not go at this study as does the scientist, nor for the same purpose. Interest in, and a simple understanding of the common facts of the world about him do not mean that the pupil has consciously grouped these facts for the purpose of arriving at law as does the scientist, but that he has a conception of their obvious relations sufficient for his common needs and to make him a happier dweller among them.

We conclude then that nature-study has within itself a prin-

ciple which can be worked out in all localities, and that its aim is the same everywhere; but that the materials of study will change with the changing surroundings, and the method with the degree of development of the child.

III

BY MAURICE A. BIGELOW

Teachers College, Columbia University

[The following is one section of a paper on "Scope and Methods of Scientific Nature-Study" read at the meeting of the New York State Science Teachers' Association, at Syracuse, December 28, 1904.]

Dealing as nature-study does with the same materials and processes with which natural science is concerned, some similarity in educational values is to be expected. Looking first at the educational aspects of natural science, we find that writers who have discussed the subject have concluded that the educational value of science study lies (1) in its discipline, and (2) in the information which has utilitarian, intellectual, æsthetic, and moral bearings. Along the same lines we must look for the educational value of nature-study.

First, with regard to discipline, it has been urged by many writers that natural science is valuable in general education above all because of its disciplinary value. Karl Pearson, in the introduction to his "Grammar of Science" has urged that "in the first and foremost place" modern science finds its support in "the efficient mental training it provides for the citizen"; and Professor Bessey, of the University of Nebraska, has said "that culture is best which so prepares a man that whatever fact presents itself to him, he will be able to arrange it accurately with reference to others."

We may urge the same arguments in favor of discipline in nature-study. Obviously this involves the question of method of teaching nature-study; but it may be taken for granted that all real nature-study, like all modern natural science, is taught on the basis of actual study of natural objects and processes. Nature-study so taught ought to have some of the discipline which natural-science study gives. It ought first of all to train the pupils in careful, critical observing; and this ought to lead the pupils to much independent observing. Moreover, such nature-

study ought to teach the pupils to appreciate the value of knowledge demonstrated to be true so far as our senses can determine; and it ought to teach them to compare facts, judge their values, and arrange them with reference to other facts. In short, nature-study properly conducted ought to give the first training in the scientific method in which natural-science studies are able to give more advanced and more complete training. Along this line we have, I believe, one of the greatest values of nature-study—one which we have scarcely begun to appreciate and in which is the possibility of greatest advance in nature-study. As will be suggested in a later section of this paper, with advances in developing the disciplinary value there will come improved selections of more valuable subject-matter.

But we must not defend nature-study simply on the ground that the method of study affords discipline in observing, experimenting, judging, reasoning, etc. The value of such mental processes depends largely upon the ability to apply them in useful lines in every-day life. Karl Pearson admits that, while science-study trains the judgment, it does not necessarily follow that the scientific man has good judgment in every-day life involving fields other than sciences, because he may not be able to carry his scientific method outside the field in which he has acquired it. Likewise, the discipline afforded by nature-study will be valuable in proportion to the pupil's ability to apply it in a useful way. A pupil trained to see the details of structure or activity in a particular object on which attention has been specially centered may not be any better able to observe things in general as he meets them in daily life; and moreover the trained ability to note details is not necessarily associated with ability to discover points of general human interest. As an example, the detailed study of postage stamps might well train the observation, but training to observe with regard to the peculiarities of postage stamps does not mean expertness of observation, although perhaps some improvement, with regard to other things, *e. g.*, common objects in nature. Therefore we could not justify a detailed study of postage stamps on the sole ground that it trains the observing powers, because the value of this is doubtful so far as useful application of the training is concerned. But a study of postage stamps with reference to the history and geography which they suggest might be made a very useful exercise, because the

attention might be directed towards things which it is useful to know. This illustration must suffice; but it must be obvious to all who will stop to consider various similar illustrations which are readily called to mind that the value of the power of observing depends, as stated above, largely upon using the power in useful ways. This in its turn involves attention and interest, and the conclusion must be that the discipline of nature-study is best which trains the pupil to apply the method in useful ways—to observing things in nature which are important enough to deserve attention in the busy life of the average citizen. It is here that the discipline and the information of nature-study must go together, for the value of the discipline will in no small measure depend upon the usefulness of the information.

Now, the usefulness of the information gained through nature-study is along æsthetic, utilitarian, intellectual, and moral lines; and the teaching of nature-study which is directed towards the facts which clearly have valuable relations to every-day life in these lines will at the same time make possible discipline which is most valuable.

Summarizing, we may defend the place of nature-study in our educational system on the ground that it gives discipline and information which are useful in the life of the average citizen.

From this brief outline of the educational value of nature-study, we pass to a statement of the aims which, obviously, grow out of the values. I have previously stated[1] these in outline form as follows: (the numbers refer to order of statement not to relative value) (1) To give general acquaintance with and interest in common objects and processes in nature. (2) To give the first training in accurate observing as a means of gaining knowledge direct from nature, and also in the simplest comparing, classifying, and judging values of facts; in other words, to give the first training in the simplest processes of the scientific method. (3) To give pupils useful knowledge concerning natural objects and processes as they directly affect human life and interests.

The first aim (for acquaintance and interest), finds its justification chiefly along moral and æsthetic lines. It is really the basis of most of the nature-study work which has been done in this country. The second aim (for discipline) simply stands for the

[1] In *Teachers College Record*, 5: 35. March, 1904.

practical method of study with special emphasis on accuracy in observing and reasoning. The third aim (for useful knowledge) looks towards results which are primarily useful for their own sake; but which *secondarily* and *incidentally* may come into relation with the study of natural sciences of the higher schools. With differences in materials and advancement of pupils the emphasis upon the three aims will naturally vary; but no series of lessons and especially the work of no one year should fail to give fair representations to the kind of teaching suggested by each of the three aims as stated. There is no conflict between these aims. The first depends upon the teacher's attitude towards and interest in natural objects and processes; the second is simply a method of teaching; the third means nothing but selection of useful facts for emphasis. How can such a combination mean a conflict of aims?

I know that some teachers will answer, as some authors have written, that the formal development of lessons which the very statement of the aims suggests—and especially the second aim (for accurate, critical work)—is opposed to the first aim (for interest in nature) so completely that the "life and interest will be taken out of nature-study" and the pupils will hate the subject as they are commonly supposed to hate all serious work of the school. This, if true, is a serious criticism. Limitations of space will not allow proper defense here; but I intend to refer to it in a paper on "Informal Nature-Study" in some future issue of this journal and describe some work observed in certain schools in which nature-study is "good fun" and at the same time serious, critical work.

PRINCIPLES OF NATURE-STUDY

BY PROFESSOR JOHN M. COULTER

The University of Chicago

[EDITORIAL NOTE.—This paper was prepared quite independently of the preceding symposium; but it touches so definitely upon educational values and aims of nature-study that it should be read in connection with the papers which discuss the problems of aims and values.]

Under the name of nature-study work has been introduced into the schools that is hard to define. It seeks to supply a need that

is evident enough, but whether it actually does supply it is an open question. The statements of its purpose range from cultivation of a sentimental love for nature to training in habits of exact observation and inference. When to this confused statement of purpose there is added the fact that it has been thrust upon a host of unwilling and unprepared teachers, it is no wonder that "nature-study" is an ill-defined, inchoate thing, the despair of the primary teacher and the joke of the scientific fraternity. And yet, its purpose is sound, and it must outgrow its ill-defined beginnings. It is certainly a great problem, to be solved by extensive experiment rather than by preconceived notions. I am quite prepared, therefore, to find that some of the suggestions I am about to make will be disapproved by experience.

In the outset it is well to state the purpose of nature-study as clearly as possible; not its incidental advantages, but its dominant motive. Naturally it is just here that we may part company, but the dominant motive must determine the method. In my judgment the great function of nature-study in elementary education is to supplement what may be called the conventional education. The latter of necessity compels attention to certain abstractions of language and numbers that are not of paramount interest to the pupil at the time. At the same time, the child possesses what I have called "tentacles of inquiry" that are extended towards natural objects. Too frequently a strictly conventional education atrophies these tentacles through disuse, and when later in life the opportunity for work in science presents itself, there is no response, for loss of interest has followed loss of power. I believe that this benumbing effect of the exclusively conventional education upon the natural interest in observing has much to do with the small proportion of college students attracted to the laboratories. What I have called the conventional education is necessary, but it needs to be supplemented by nature-study in order that the tentacles of inquiry may remain functional. To me the keeping functional natural powers is the fundamental purpose of nature-study in elementary schools, that later in education and later in life the pupil may not be robbed of opportunity and enjoyment. If this purpose be sound, the methods of nature-study are to be judged by their success in fulfilling it.

This leads first to certain criticisms of much work in nature-study that I have observed. How extensively these criticisms

apply I have no means of knowing. Of course the most obvious weakness is the unprepared teacher. For the most part they are not to be blamed, for the work has been thrust upon them, and they are more or less conscious of their helplessness; and, furthermore, quite a number of the reputed leaders in the subject are distinctly "blind leaders of the blind."

Accepting the teachers, however, such as they are, my first criticism of observed methods would be directed against what I have been in the habit of calling "dead work"; which means the observation of insignificant, trivial things; work that means nothing when it is done. I realize that many a teacher, through lack of knowledge, is compelled to occupy the time with anything that occurs to her, and is sometimes honest enough to call the exercise "busy work." For example, I have seen period after period given to a study of the forms of leaves, chiefly because the forms are endless and illustrative material is easily obtained.

A second criticism of observed methods is the attempt to arouse a factitious interest in nature-study by all sorts of playful and imaginative devices. Most of the books dealing with nature-study cater to this tendency and perhaps are largely responsible for it. These devices disgust strong children, just as does the foolish and forced sprightliness of many primary teachers. Nature-study, imbedded as it is in conventional education, is the one chance for exact and independent observation, for cultivating the ideas that between cause and effect there can be no hiatus, that imagination is beautiful and most useful in its place but that its place is never to lead to a misconception of facts, and that there should be no playing fast and loose with truth.

Passing from the statement of purpose and criticisms of observed methods to a statement of principles, I would say that if the purpose of nature-study is to keep functional the tentacles of inquiry, it follows that a test of success is *interest*. It is evident, therefore, that no science can be presented in any completeness or in any definitely organized sequence, and hence the purpose must be *continuity of interest* and not *continuity of subject*. The resulting interest must be checked by the objects of interest, which must be important, and so I reach my general thesis that *nature-study must look to a continuity of interest in important subjects*.

What are appropriate subjects? I would suggest an answer under three heads: (1) *Things of common experience*. This

means that there can be no fixed schedule appropriate for every school, and it also means an adaptable teacher. The teacher who has secured a definite "outline" from some one is in danger of passing by the most important natural objects within reach of the school. I have seen such an "outline" prepared on the seacoast and used by a teacher in the central west. When it came to the subject of seaweeds, a few miserable things were obtained with much difficulty from the seashore, and the glorious forest with which the school was surrounded was left without observation! This is an extreme case, but essentially the same thing is common enough. (2) *No subject should be pressed too far,* for interest may pass into disgust. Watch the pupil, not the outline! (3) *Observation should be directed more towards activity than towards form and structure.* It is fundamental in botany that plants be regarded as things alive and at work; and it is also of far greater interest to a child to watch a plant doing something than to observe form and structure, which in the very nature of things mean nothing to the observer.

What are appropriate methods? (1) Very definite work, that has already been traversed by the teacher; for it is confusing and discouraging and disastrous to work at random. Some very definite result must be plainly in sight. (2) Individual work in observation or experiment, which means personal responsibility. (3) Unprejudiced observation, which means that the pupil is not to be told what ought to be seen; some children are so docile that they never fail to see what they are told to see. (4) Bringing together and comparing individual results, a thing of fundamental importance, for it develops differences in results which must be settled by repetition, shows what is essential in the results and what amount of variation is possible, develops the habit of caution in generalization, and impresses the need and nature of adequate proof.

What are appropriate results? (1) A sustained interest in natural objects and the phenomena of nature. (2) An independence in observation and conclusion. (3) Some conception as to what an exact statement is. (4) Some conception of what constitutes proof; in short, an independent, rational individual, such as the world needs to-day more than anything else. I feel strongly that our educational system lacks efficiency in just this direction, and that continuous training in exact observation and inference,

beginning with the kindergarten, must result in more sanity among adults.

CHILDREN'S GARDENS AT DOWNING STREET SCHOOL, WORCESTER, MASS.

BY EDNA R. THAYER

Teacher of Grades Two and Three

Photographs by C. F. Hodge

Very early in the spring of 1903 all the children in the schools of the city of Worcester were offered seeds for planting by the leading seedsman, and many teachers who were interested in garden work gladly accepted the offer for their pupils. At the Downing St. school the children were allowed to choose their own vegetable seeds; but in the case of flower seeds the easily grown varieties like the nasturtium and calliopsis were given to the lower grades, stocks and carnations to the older children. All flower seeds were planted in pots at home in accordance with directions given about drainage, soil, depth to plant, and care to be given. This flower growing was successful and on the last day of school the children brought their plants, with pots gayly dressed in fancy paper, for an exhibit. Some very good radishes and lettuce were grown in beds in the school-yard, but no attempt was made at a report of vegetables grown at home.

This spring, 1904, when the same offer of seeds was made, it seemed wise to attempt gardening on a larger scale, as the first trial had shown that the children were eager for the work, and we were satisfied that gardening ought to be made a permanent part of our course in nature-study. As I was especially interested, it naturally fell to my lot to distribute the seeds and supervise the work through the summer. I decided that the gardens must be at the children's homes, because there was no available land near the school, and more particularly because each child would feel that it was *his own* garden and that he had a personal responsibility for every seed given if it was at *his* home. Notes were sent to the parents asking their consent to the children's having seeds, and permission was readily obtained for more than four hundred children. Each child selected three kinds of seeds, either

A home-garden planted and cared for by a girl of twelve.

The largest of the children's home-gardens.

flower or vegetable. The choice was not always wise, for some of the younger children, probably acting on suggestions of their parents, chose seeds most difficult to germinate. Girls and boys were about equally divided in their choice of flowers and vegetables, which was much to my surprise; and later in the summer I found the girls quite as successful vegetable gardeners as the boys.

During the days following the distribution of the seeds little conversation was heard about the school building and neighborhood save of planting; and it soon became evident that what the children lacked in knowledge and experience they made up by their enthusiasm. Would it last through the summer, was the question. It seemed necessary that the children should be watched over and encouraged, and so they were told that I would visit their gardens when they were well started and that my disappointment would be great if they had nothing to show me. They were told, also, that the New England Agricultural Society had asked the school children to make exhibits of flowers and vegetables at the fair to be held in Worcester early in September and that it was hoped that every child in Downing St. school would raise something worthy of exhibit. It was understood by every child that if he were assisted by others in the production of his flowers or vegetables, they would not be eligible for exhibit at the fair. Knowing this, a little girl in the lowest grade chose only vegetable seeds in order to avoid any suspicion that her father, who was a florist, had helped her.

As soon as the home-gardens were fairly started, work was begun on some garden beds for the school-yard. The year before we had made an attempt at a flower bed, but in our ignorance had made it by heaping the loam on the hard gravel of the school-yard and in midsummer our plants wilted and died. We had thus learned from experience that the bed must be lowered nearly to the level of the yard to prevent drying out. Volunteers removed the loam, excavated through the hard gravel to the depth of eighteen inches, then replaced the loam. New beds were made in the same way, two for flowers and one for vegetables and a fourth for a dozen varieties of sweet herbs. Boys and girls in the school volunteered to care for the beds; and, with an occasional reminder, they were kept well weeded and watered throughout the summer.

As soon as there was something to see in the home-gardens, I began to visit them whenever I could before and after school until

the term ended and after that I made systematic visits, a street at a time, until all were inspected. I saw gardens good, bad and indifferent; the first, however, being largely in the majority. Of the bad, in most cases the child was not to blame, for the failure plainly resulted from poor soil or lack of sunshine. The gardens which I term indifferent belonged to the class of children who delight in beginning new things but who have not the moral

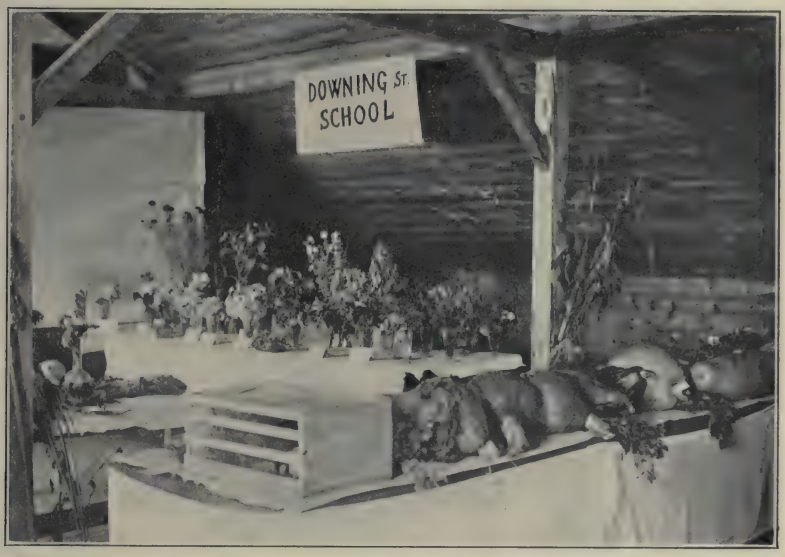
"The comparisons which a child would draw between his garden and those of his neighbors were interesting and helpful."

stamina to push on to a completed result. However, the lesson was probably helpful, so far as it went. In very little of our educational plan is a subject studied to completion; everything learned or done is a fragment which some day may serve a purpose which we can not foresee.

As the summer went on and hot, sultry days came, it was wonderful how many gardens did do well. Even the transplanting was done so carefully and the plants so well protected from the sun's rays that few were lost. Mothers told me that their children did not wish to go away even for a few days, because the garden would need attention during their absence. The comparisons which a child would draw between his garden and those of his

neighbors were interesting and helpful, and the boy or girl whose garden was a little in advance of the others was indeed envied.

When the time for the fair drew near, in order to know definitely what each child would contribute, postal cards were sent to every family whose children had been successful in their work, directing how to cut the flowers, prepare the vegetables, and that they be brought to the school-house at an early hour on the morning of the opening of the fair. Wagons had been secured to



A corner of the exhibit at the agricultural fair More than thirty kinds of vegetables and all common varieties of flowers.

carry the exhibit to the fair-grounds. Every child who exhibited was given an exhibitor's ticket, allowing free admission each day. This privilege alone more than repaid the children for the hours of labor spent in the garden work, for no child ever could stay long enough at an agricultural fair, and a large percentage of the children had never before attended one.

The judges awarded the Downing St. school the first premium of $7.00 for the best collection from any one school. Thirteen other premiums were won by individual children of the school —six first premiums, four second and three third—amounting to $6.00 more. There were more than thirty kinds of vegetables

exhibited, the largest production being two mammoth whaleback squashes weighing twenty-eight and twenty-nine pounds apiece, and the most unique, a handsome pepper plant, full of peppers, growing in a tin pail. The flower table included all common varieties from the showy nasturtium and marigold to the dainty pansy and the sturdy dahlia. The finest golden marigold plant that I have ever seen, one literally covered with huge blossoms, was grown and exhibited in a large pot. A little girl was the proud owner and she won the first premium for marigolds. Many people sought the attendant to inquire if the exhibit was entirely the work of the children, none of whom were over fourteen years of age, the youngest were but five, and the average was probably not more than ten.

I doubt if any summer ever spent by the children of the Downing St. school has been as profitable as this one. They had definite, pleasing, out-of-door occupation; and not once have I heard a complaint, heard so often summers before, that the mothers would be glad when school began so that boys and girls would be away from the street and its dangers.

WHY SOME SCHOOL-GARDENS ARE FAILURES

BY T. R. CROSWELL

Supervisor of Training School, Los Angeles, Cal.

What is a school-garden? On your answer depends very much the success or failure you will make of one.

The school-garden of certain parts of Europe forms a portion of the income of the tenant schoolmaster. It is more than an experiment in showing how things grow. It represents a successful venture as well as an object lesson in elementary agriculture. Such conditions do not exist in the public schools of America. Yet many writers, advocating the school-garden for our schools, cite these foreign ones as models.

One of the best known school-gardens in the United States consists of limited beds in all sorts of available corners of a limited school-yard. In one corner a group of children care for a bed of flowers, in other angles other varieties are cared for by other groups. Some are wild flowers, some are domesticated. Through

this garden the children of this city school have come to know many wild flowers that otherwise would have remained strangers; some knowledge of the care of plants has been imparted; and the beds have furnished specimens for analysis and study in the classroom. This work is well adapted to the needs of the pupils of this particular school, and the garden deserves the reputation it possesses. Yet would you say that *your* school-garden exists for the purpose of teaching the recognition of wild flowers, learning to care for them, and of raising supplies for the botany and art classes?

Many school-gardens are planted with vegetables of all sorts—radishes, lettuce, cabbage, cauliflower, potatoes, squash, corn, beans, etc. In fact, some of them show a sample of almost everything which might be grown in a market garden. It would be difficult for anyone to say why all of these are planted; certainly it would be impossible to give an adequate reason for each. But all are planted regardless of the location of the school, whether in a large city or in a country district. It is probable in both cases the object, as stated, is to enable the children to see these vegetables in the process of growth. The object may be, however, to show how to grow different vegetables. But whatever the aim, the result is the same in the majority of cases. The garden is started late, so that only a few radishes mature before the close of school. These are gathered and eaten. Then comes the long summer vacation and the end of the school-garden as far as the children are concerned, for in most instances the conditions are such that the garden, which was started amid much enthusiasm and with some promise, ends in unsightly neglect. The children have seen something growing; they have, if the conditions were favorable, had an opportunity to exercise a measure of responsibility during the early growth; but for the most part they have experienced the discouraging effect of failing to complete what they started to do. The evil effect of such failure, apart from its demoralizing influence on the general character, is more than an offset to the good which may come from any knowledge gained. The creation of a desire for plant culture, which should be the result, is lacking; not only that, but the fresh enthusiasm of the first attempt it lost. Never again will there be such an opportunity to develop in the same pupils a genuine love for

gardening and the wholesome influences which come with the successful nurture of plants.

These examples are sufficient to show that the conditions existing in one locality may not exist in another. The conditions will modify both the aim and the possibilities of the garden. In each case the purpose of the garden should be definite, and should be determined beforehand, by the nature of the surroundings and the possibility of success. To attempt the impossible does not speak well for one's sanity; not to know what you are trying to do shows lack of business ability; to encourage your pupils in a forlorn hope is dishonest, and the effort is foredoomed to failure.

Summarizing, a school-garden has often failed for one of the following reasons: It was simply an imitation, a fad without a purpose; the purpose was too general; it was not adapted to existing conditions; or the connection between the end sought and the plan followed was too loose.

The success of a school-garden should be measured, not by its extent, nor by the opportunity which it offers for securing photographs of groups of children at work, but by the effectiveness with which it supplies the means of satisfying a genuine need on the part of the pupils of a given school. Two gardens may be equally successful, yet widely different. In a large city school where the children have little opportunity for either observation or work in the soil, to plant for the purpose of seeing how the common vegetables grow, even though there may be no prospects of any crop, is entirely proper, provided the children are not encouraged to hope for the impossible. If, however, such a purpose is the leading one in a village or small city where the children see the different plants growing under more normal conditions, and where by a little encouragement they can be led to work their own little plots at home, then such a garden shows stupidity on the part of the promoter. In the smaller place its purpose should be much more specific; the school should put much more emphasis on the multiplying of plots at home, and less on show at school; more on specific knowledge of how to cultivate those things within the ability of the child that may add to the beauty or attractiveness of the individual home, less on how radishes or potatoes grow; more attention to those things which can be surely grown, and which by their success will deeepen and extend the interest in such soil lore as will make lives happier, purer and more useful.

CHEMICAL TABLETS FOR FEEDING PLANTS GROWING WITHOUT SOIL

BY EDWARD F. BIGELOW, Ph.D.

Editor of "Nature and Science" in St. Nicholas. Author of "How Nature Study should be Taught"

[EDITORIAL NOTE.—The experiments described in this paper are so practicable and adaptable to every schoolroom that they deserve to be familiar to every teacher of nature-study. For this reason we have urged the author to re-write the earlier accounts of his experiments and make them more generally available for teachers of nature-study and high-school biology.]

I am requested to tell teachers how I use in tablets the chemicals of Sachs' nutrient solution for the artificial feeding of plants. For those not familiar with feeding plants with chemicals I first quote briefly from Professor Sachs:[1]

"The complete revolution which rational agriculture and forestry have experienced through the establishing of the theory of the nutrition of plants, proves how much has been accomplished in this department. It would extend far beyond the scope of this lecture to reproduce even briefly the substance of the literature of the subject. The most significant result of the development of the nutrition theory is met with, however, in the fact that we are now able to rear plants artificially—that we are in a position, with chemically pure water to which we add some few chemically pure salts, to rear artificially highly developed plants as well as the simplest algæ (and *mutatis mutandis,* also fungi)—that from inconspicuous and often scarcely ponderable quantities of vegetable substance, quantities of it as large as we choose may be produced in this way.

"Such being the favorable position of affairs, I regard it as the simplest and most instructive method to connect the main points of the theory of nutrition of plants, so far as they concern the food materials, with the description of an experiment in artificial nutrition made with a highly organized plant. I think that in this manner the essential and important points come into view more clearly than with any other mode of exposition. In the year 1860 I published the results of experiments which demonstrated

[1] See Lecture XVII, "The Nutritive Materials of Plants," in Professor Julius von Sachs' "On the Physiology of Plants."

that land-plants are capable of absorbing their nutritive matters out of watery solutions, without the aid of soil, and that it is possible in this way not only to maintain plants alive and growing for a long time, as had long been known, but also to bring about a vigorous increase of their organic substance, and even the production of seeds capable of germination."

I have utilized all that this honored botanist and others have recorded regarding artificial nutrition of plants, and have added these three points: (1) Convenience of supplying the chemicals in tablet form. (2) Novelties (to attract the young folks) in situations of growing plants. (3) A germinating case for scientific or popular observation and experiment.

This is how I came to use chemicals in tablet form for feeding plants. For many years I have been visiting schoolrooms and talking to the young folks on nature-study. I have also been accompanied by young folks, in parties of from a few to two hundred and fifty in number, on natural-history excursions along the roadsides, across the fields, through the forests and in the meadows and swamps. In a single year I have taken as many as 4,500 girls and boys on tramps aggregating more than 175 miles. Most of this has been in the spring; but just why I have never been able to understand, for surely Nature is interesting at all seasons. But requests for the help of the naturalist-guide come almost wholly in the spring. At this season plant life is especially active, new, living and growing. That is—let me qualify this statement—the plant life outdoors to which I introduced the young folks. Indoors that to which they introduced me, in the form of seeds germinating on cotton, blotting paper or sawdust, most frequently suggested death rather than life. Sometimes the mass would be decaying, filthy, ill-smelling, disgusting. And the young folks would apologetically say, "You should have seen it a few days ago, then it was growing nicely."

At this same time, plant life outdoors was becoming better and better; every day added to the charm, and brought new interests. Gradually the impression deepened that something was wrong. Every time the young folks or teachers called my attention to germinating seeds in bad condition I felt a jar of discord. I admit that it took several years of such experience to formulate itself into more than annoyance, and to become a determination to find a remedy. I was familiar, as are most teachers of botany,

FIG. 1. An egg-shell garden. Several common plants grown three feet tall from sawdust in egg-shells Sawdust kept moist with water during germination and afterwards with the solution

FIG 2. In center "agateware" pan cotton plants are growing in bits of crushed stone. In outer pans beans are growing in sawdust Fed by the nutrient solution

with Sachs' solution from experiments made several years before in a university laboratory; but it took time for the suggestion to arise that the solution could be used aside from technical experi-

FIG. 3. Oats in a lamp-chimney "struggle for existence." Wrap a roll of cotton in black cloth, push it into the chimney, and then with a stick or wire poke seeds in between glass and cloth. During germination keep moist with water, and afterwards with the solution.

Hairy vetch on cloth netting stretched over the mouth of the tumbler, the roots hanging down into the solution. Many other common plants grow well in same position.

ments, and by the young folks as a common plant food. But one day light came. I ordered some of the mixture in bulk, put up loose in two-ounce packages. Later, as I saw a physician leave tablets for a patient and heard him refer to the convenience of

these over the old method with powders and mysterious mixtures, the suggestion came to mind—Why not put up those nutrient chemicals in tablets? I at once gave an order to a manufacturing chemist for 10,000 compressed tablets. This was in the early part of 1900. All that spring and summer I experimented with my tablets, as did a few teachers of botany to whom I gave a supply. We used the entire 10,000. They were found to work marvellously well, even beyond my fondest hope. The first public announcement was on page 557 of "Nature and Science" of *St. Nicholas* for April, 1901, in a series of prizes offered to the young folks for germinating seeds. The result of that contest, during the summer and autumn of 1901, was astonishing. The children made use of the tablets most successfully in growing plants in all sorts of ingenious situations. I was deluged with letters from young folks, teachers and parents, describing experiments. Several of these letters and a number of illustrations were published during the following spring in *St. Nicholas* (April, 1902). Later accounts were given in *School Science,* Chicago; and *Popular Educator,* Boston.

Each of the tablets is composed of the following: Common table salt (sodium chloride), 2½ grains; plaster of Paris—gypsum (calcium sulphate), 2½ grains; Epsom salts (magnesium sulphate); phosphate of lime, nearly the same as burned bones (calcium phosphate), 2½ grains; East Indian saltpetre—nitre (potassium nitrate), 5 grains; compounds of iron and chlorine (ferric chloride), nearly $\frac{1}{10}$ grain. To make the food solution, two of these tablets are required for each pint (500 ccm. nearly) of water. Crush the tablets to be used and put the powder in the water. Shake or stir thoroughly before using. Keep the plants thoroughly moistened with this solution, which is both drink and food for them.

The solution prepared from the tablets will nourish a plant if the roots can be kept supplied with it, even on top of a stone, or a brick, between two sheets of glass (see Fig. 4), on crushed rock (see Fig. 2), sawdust (see Fig. 1), pebbles, bits of glass, or any similar insoluble substance. Plants thrive well on perforated cloth or wire-netting stretched tightly across any receptacle that is kept filled with the solution (see Fig. 3). The photographs published in *St. Nicholas* and other periodicals to which I have referred and also the new ones accompanying this article show some

of these situations. But for novelty or scientific experiment there are many others equally good. Plants may even be suspended in

FIG. 4. White lupins, growing from successive plantings in a germinating case made of two sheets of glass tied together with cotton wadding next to the back glass and a layer of black close-woven cloth between the wadding and the glass in front. The cloth is for a dark background and to force the roots to grow in one plane between the cloth and glass in front. The case is kept standing on edge (see Fig. 5). The seeds are planted on the upper edge between the front glass and the black cloth, and kept moist (with water until rootlets appear and then with the solution). Strips of cotton should be used to cover the edge and protect the seeds from drying until the plants begin to grow (see Fig. 5). At the end of two weeks there is a living chart showing successive stages.

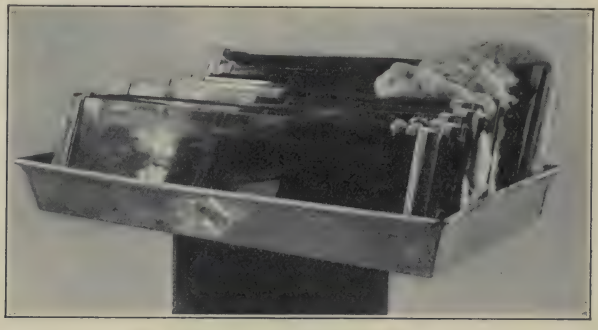


FIG. 5. Germinating cases, described in connection with Fig. 4, arranged in card-catalogue style in an enameled pan. By this arrangement space is economized and the roots in each case, except the one in front, are darkened by the adjoining case. A piece of black cloth may be used to cover the front glass. The excess solution poured over the upper edges is collected in the pan, and from time to time is used again to moisten the cotton above.

mid-air and grown, if the roots are kept moist with the solution. Apply the solution to the roots in any way that you please, keep

the stem and leaves in the light, and the whole plant will grow and thrive if it is kept warm. I have not found so much advantage in keeping the roots in darkness as I had anticipated. In most of my experiments they have been wholly in the light. This is undoubtedly somewhat of a disadvantage to the plant, but to be able to watch the development of roots adds greatly to the interest.

I have found the tablets somewhat helpful as a fertilizer, but my belief is that they are most efficacious when they are used alone and not added to earth or other nutritious substances.

Contrary to the persistent belief or to the inquiries of most young folks and of many teachers, let me say that the tablets do not germinate nor aid in germinating the seeds. They feed the plant after the tiny roots have been formed and are ready to take food. In fact, the application of the chemical solution in the very earliest stages of germination has seemed to me to be a disadvantage. To germinate a seed only three things are necessary: warmth, moisture and air. It will not germinate with only one or two of these. It must have all three. The tablet solution will not supply the warmth nor the air, and the moisture is better supplied by water than by the solution. Darkness is helpful, but not an absolute essential for germination. Allow the seeds to sprout in the ordinary old-fashioned method on moist cotton, blotting paper, etc., and apply the solution only to feed them as soon as the young plants tell you by starting their roots that they are ready for food.

For four years I have experimented extensively with this solution by growing plants in a great variety of situations. This has not been work, it has been play, most enjoyable hours snatched from the pressure of many duties. I have come to love plants, not alone from the scientific or the esthetic standpoint, but as pets. My desire has been to create and increase an interest and love for the growth of our common plants, in their entirety, as living things. It is not enough to know the flowers, not even enough to know the plants, that is at any one stage of their existence, in the sense of knowing either the name or structure. The message coming to us from the Great Nature-Study Teacher, regarding one species of plants, was intended I think to apply to all. He said "consider the lilies of the field *how they grow.*"

[**How to obtain the tablets.**—A box containing 30 tablets, with full directions for use, will be mailed for ten cents—a very small amount which is

just sufficient to pay for the tablets, printing, packing, and postage. The author has no financial, only an educational, interest in the sale. This low price is possible only because thousands of boxes are prepared at a time by a manufacturing chemist. Large quantities have been purchased by schools, and colleges find them most convenient for making the standard Sachs' solution. Address Edward F. Bigelow, Stamford, Ct.—MANAGING EDITOR.]

A NATURE-STUDY LESSON WITH THE MOLDS

BY PROFESSOR F. L. STEVENS, Ph.D.

North Carolina College of Agriculture and Mechanic Arts

Molds of bread, cheese and fruits are only too common objects in the household; but little real knowledge prevails regarding their nature, mode of origin or effects. This field of observation and experimentation is so little known that it is by most teachers either never thought of at all or considered too difficult to be of use to the nature-study classes. Many simple and instructive experiments, however, may be made in any school at no cost with these simple plants, and much interest aroused and knowledge attained.

Experiment 1. To see whether any desired kind of mold can be produced at will upon moist bread.

Have one or two of the pupils place a slice of moist bread in a glass fruit-can and heat it in a steamer just as you would in canning fruit. Then seal it up while hot also just as you would in canning fruit. Bring these cans to school. Also secure some moldy cheese or bread. Suppose the cheese has on it a yellow mold. Now the problem is to see if we can grow this yellow mold in the bread. Heat the tip of a hat-pin in a match or lamp flame, let it cool a second and dip it into the yellow mold. Now draw this hat-pin across the bread in the jar. Then close the can and watch it daily to see if the yellow mold comes in the place you have planted it. Try this experiment with various kinds of molds.

Experiment 2. To see whether molds will develop if all in the vessel are killed and all air excluded.

Proceed as you did in Experiment 1. Can the bread as you would can fruit, and let it stay in the schoolroom for a few weeks to see whether molds develop. Molds should not grow here

because you have killed all that were present in the can and bread originally and prevented any more from entering.

Experiment 3. To see whether germs abound in the air. Open the can used in Experiment 2, thus allowing the air to enter. Let the cover remain off for a day or so and observe whether the bread then molds or not. Do not allow it to become dry, since molds can not grow in dry substances at all.

Germs are drifting about in the air in very great abundance, and when the can is open many of them will fall upon the bread and begin to grow. The fact that they do develop thus shows that the air contained them in considerable quantity.

Whenever you see apples or other fruit decaying it is because germs somewhat similar to those of the bread have gotten under the skin of the fruit and are there growing, thus causing the decay. If the entrance of these germs could be prevented, the fruit would not decay. On the other hand, if germs are placed in healthy apples, decay is produced. You may illustrate by an experiment.

Experiment 4. Secure a perfectly healthy apple and a rotten apple in a well developed condition of rot, that is, an apple covered with mold. Stick a hat-pin into the mold and then into the healthy apple. Set the healthy apple away and watch it from day to day to see whether the rot develops in the place where you planted the mold.

Another disease on the sweet potato which causes the potato to become soft and mushy is a good disease to use in a similar experiment, to illustrate the same point.

From all of the above experiments the child will glean a number of valuable facts and insight and interest in a feature of daily life with which very few people are in touch.

NATURE-STUDY IN HIGH SCHOOLS

BY MAURICE A. BIGELOW

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The explanation on the cover that THE NATURE-STUDY REVIEW is a journal "devoted to all phases of nature-study for elementary schools" has led readers to inquire why nature-study is thus emphasized as an elementary-school subject when much work in the

lower years of high schools is nature-study, as defined in the first symposium, rather than study of the principles of natural sciences.

First, in explaining why the sub-title of this journal makes special mention of elementary schools, it should be said that those persons who were responsible for the initial steps towards organizing the journal held as fundamental propositions the following: (1) that nature-study and not natural science is the proper work of elementary schools, (2) that high-school studies based on elementary-school studies of nature should be advanced to the introduction of the elementary principles of natural science. Any student of scientific education will be led to similar views if he carefully examines nature-study and natural science in some of the most progressive schools in this country. It is clear beyond question that nature-study is and will be most prominent in elementary schools, and that the high-school work is decidedly in the line of organized natural science. Furthermore, the most important unsolved problems of scientific education naturally concern the beginning work, which is in the elementary schools. For these reasons THE NATURE-STUDY REVIEW was designedly "devoted to all phases of nature-study in elementary schools"; but that this primary purpose of the journal need not affect its usefulness to high-school work in the line of nature-study will appear in the following analysis of the relations of such work to that of the lower school.

With a good foundation of nature-study gained in the elementary school, it is reasonable to hold that all high-school science should be primarily real science study, that is to say, it should be close analytical and synthetical study of natural objects and processes primarily for the sake of gaining acquaintance with the general principles and methods of modern science. This is now realized in the teaching of the physical sciences in many high schools; but on the whole the teaching of the biological sciences is not well organized on the basis of scientific study of principles. To a large extent the biological work of the first or second year of our high schools must for the present give much attention to nature-study (we commonly call it natural history), because the pupils in the great majority of cases come to the high schools with little or no knowledge concerning the common things in nature around them; and the high school must first of all take up the work left undone in the elementary schools. I have

already pointed out in Chapter IV, pp. 320–327, of "The Teaching of Zoology in the Secondary School" (N. Y., Longsmans, Green & Co., 1904), that this nature-study work in the biology of high schools is probably a temporary compromise made necessary because of the undeveloped nature-study in lower schools; and that with the advance of nature-study the larger part of the natural history for the sake of general acquaintance with common living things will be taught in the elementary school, leaving the high school free to devote its time to more serious study of biology as a science, with incidental instead of primary emphasis on natural history.

But no matter what may be the future developments, the fact remains that the high-school work in natural history or biological nature-study presents no peculiar problems. It is in all essentials the same study of living animals and plants which in many schools is conducted in the upper grammar grades. Much of it is study of living things out of doors, usually for the sake of identification and general acquaintance; but this, too, is well accomplished in elementary schools. I have seen fifth-grade classes do field work in study of birds and trees which would be highly creditable to the first year of high school. We must conclude that the high-school study of natural history is so similar to the nature-study of the lower schools that in dealing primarily with nature-study for elementary education this journal will most directly approach the problems, and at the same time the materials will be just as useful to the high-school teacher who has occasion to present nature-studies either as an incidental or as a prominent part of science, especially biology.

Finally, in addition to the present reasons why high-school teachers of biology are directly interested in nature-study as a part of their teaching and the indirect interest which the best teachers of any grade of our educational system have in the lower work upon which they must build, there is still another important stimulus for interest in nature-study in that more and more the elementary-school teachers are looking to the science specialists in the high school for directions, thus leading high-school teachers to get acquainted with the problems of the lower school.

EDITORIALS

THE COLLABORATORS OF THE REVIEW

Unfortunately, it appears that many persons, and even certain journals, have interpreted the long list of collaborators as meaning an aim to include all active leaders of nature-study in the United States and in the Provinces of Canada. As a result of this interpretation, we have received several dozen letters calling attention to the fact that certain names, in some cases very well-known ones, are not among those of the collaborators of this journal. We explain as follows:

The list of collaborators does not at all adequately represent the wide-spread interest in nature-study in America. The list was originally made up on short notice from the suggestions of less than half a dozen persons who knew from personal acquaintance that certain individuals would probably give their time and influence to the movement for a journal of nature-study. The list was necessarily an extended one because the editors needed, especially in the first year, the cooperation of some representatives of each of the various phases of science in higher educational institutions and of nature-study in schools in various geographical localities. Since the prospectus was issued correspondence has indicated that many more names would have to be added if the published list of collaborators was to pretend to be a directory of the leaders of nature-study in the various States and in Canada who would gladly give their cooperation. The original list has already ceased to represent accurately those who have pledged their support to THE REVIEW, for some of our most valuable cooperation is now coming from persons whose names will not be published except when signed to articles. With this explanation we trust that there will be no more misunderstanding, and that the editorial board composed of editors and collaborators will be regarded simply an arrangement for promoting the editorial and business interests of the journal, rather than as a directory of active workers in the field represented.

ARTICLES BY THOSE WHO BOTH THINK AND DO

The first two numbers of THE REVIEW give prominence to more or less theoretical papers on the educational problems of nature-

study, and naturally most of these papers have been contributed by writers who have approached nature-study from the viewpoint of the broader questions of education which appeal especially to college men and school officials. This represents, however, but one side of the problem. We must have the opinions of those who are able to observe and reason concerning nature-study; but we must give an equally prominent place to the results obtained by teachers who are actually at work in the elementary schools. As an example, we have one such paper (on school-gardens) in this number, and will have several in the next. Teachers who work out even minor points which may interest others are invited to send concise accounts of their results to the editors of this journal. We can not promise to publish everything; but we want to have available a generous supply of material from which to make selection guided by our best judgment as to what best represents actual doing in the field of nature-study.

ORIGINAL OBSERVATIONS

Very frequently in connection with the nature-study work in schools there is observed some interesting point which is apparently new, or at least not mentioned in the books commonly accessible. Records of several such observations have already been sent to the editors, and some of them will be published with critical notes by experts. Teachers are invited to send brief accounts of observations which they think may prove to be new.

BOOK REVIEWS

Animal Stories Retold from St. Nicholas. Six volumes planned, two published. Edited by M. H. Carter, of New York Training School for Teachers. N. Y., Century Co. 1904. About 200 pages each, illustrated. 65 cents each.

The introductory volume of this series is entitled "About Animals." The aim of the series as therein stated is to give young readers "some idea of the great animal world, and to set them thinking about our relation to it." In consequence the information and anecdotes selected for this volume cover a wide field. In addition to narratives and some rhymes about animals, certain sections are introduced to awaken scientific interest and to empha-

size the natural-history point of view. Of these chapters, "A Brief Survey of the Animal Kingdom," states the most important facts of animal classification in very simple language, and is evidently intended to help children place the various common types. The chapter is too brief to serve for more than this, and if used in connection with animal study should be supplemented by fuller explanation and illustration.

In the chapter, "Mother Nature and the Jointed Stick" the description of the use of the vertebrate skeleton and the muscular control of the body is introduced by means of an analogy which confuses rather than clarifies, but the structural comparison between the human and other vertebrate skeletons is interestingly shown by a number of ingenious diagrams.

Chapters of special value for arousing interest in animals in their natural environment, and for fostering a desire to protect and study them in their wild state are, "Animal Tracks in the Snow," "How some Animals become Extinct," and "Hunting with a Camera."

The remainder of the book is made up of stories of animals in captivity and as pets of man. The stories are well told and are full of interest, pathos and humor together with many accurate and valuable observations of animal ways. In this connection, it is not obvious why the chapter on the mounting of large animals is introduced. This undoubtedly gives us a glimpse of an interesting and difficult art, but does not aid in furthering the aim of the book as stated by the editor.

The book is full of interest and will be especially enjoyed by children of about ten or eleven years of age, and portions of it may profitably be read to still younger children. As far as school use is concerned, it would seem of most value if used by the teacher for supplementary lessons on animal life, by reading aloud portions of the book and discussing the story or sketch with the class in such a way as to bring out certain characteristics of animal life or structure.

The second volume under consideration is "Cat Stories." This volume is made up of eighteen short stories and rhymes about cats exclusive of other animals. For this reason the book will not appeal so well to the interest of children as the more varied volume "About Animals." The stories are rather more

entertaining than instructive, but cat ways and characteristics are well described. The book has a peculiar value from a narrative standpoint, and some of the best stories might be read to children in the primary grades with a view to oral reproduction. The stories are well told in simple language, and the facts are interesting and appeal to young children. The book is, however, too special to be used as a supplementary reading book.

Both books, "About Animals" and "Cat Stories," are well illustrated with reproductions of photographs and original drawings and the paper and print are good. The books are well worthy to be placed in any school library for children of the upper primary and lower grammar grade.

ELIZABETH CARSE.

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New York City.

Since the above review was set in type four other volumes completing the series have been received: "Stories of Brave Dogs," "Lion and Tiger Stories," "Bear Stories" and "Panther Stories." These are in all essentials like the "Cat Stories" reviewed above, and the same general commendations and criticisms are applicable to them. All the volumes of the series will undoubtedly be well received as books for home reading and for school-libraries.

M. A. B.

How Nature Study Should be Taught. By Edward F. Bigelow. Introduction by J. P. Gordy; appendix, "How to Introduce Nature-Study," by H. A. Surface. N. Y., Hinds, Noble & Eldredge. 1904. Pp. 203. $1.00.

This series of talks to teachers is not, as the title might suggest, a book of special method—though there is considerable pedagogy in it—but rather is it a plea for the more general and sympathetic teaching of the subject. The author was, for eight years, the editor of *The Observer;* for three years editor of *Popular Science,* and for the past five years the editor of the department of Nature and Science in *St. Nicholas.* He is known as a lecturer and is not without experience as a teacher. However, the point of view throughout the book is rather that of the school patron than of the teacher. The author, evidently an ardent nature-lover, is interested in children and desires that nature be por-

trayed "from the standpoint of the child." He does not tire of insisting upon the distinction between elementary science and nature-study, which, as he sees it, is a distinction between the imparting of scientific knowledge, with the inculcating of habits of scientific thinking, and the development of a love of nature. Personally we are inclined to the belief that scientific method, both on the part of the teacher and eventually on the part of the pupil as well, is inseparate from a satisfactory handling of nature-study. "What I have had in mind," to quote from the opening chapter, "is not a matter of learning nature, but of loving her." To this we are wont to answer: "Yes, but 'even so faith, if it hath not works, is dead, being alone.'" Later he adds: "It is nothing less nor more than taking an intelligent interest in the earth and its products." Ay, there is the saving word—*intelligent*. What in the author is a fine sentiment may easily take the form of the rankest sentimentality in a teacher whose loving does not lead to a desire to *know*.

In general, as Professor Gordy says in his introduction, the pedagogy of the book is entirely sound. What at first appear as extravagances are seen to be only the overflow of ardor, and statements which seem extreme are later modified. That a distinction must be made between elementary science and nature-study we must heartly agree, but mental activity should be demanded in one as in the other. With increasing maturity comes a measure of ability to divorce the intellect from the emotions without damage to either.

Perhaps our greatest fault as teachers of children lies in our failure to adopt the viewpoint of the pupil. The author makes this very clear, and in urging a more sympathetic interest in the out-door life of the child he has probably given us his most valuable contribution. "To overcome the onesidedness of a school limited to mere instruction, nature-study has been introduced as the most valuable field in which to let the child do the telling." Quoting from C. B. Scott: "More than is the case with other studies, probably, science, or nature-study, deals with the individual child, and aims to develop each child as an individual."

We do not feel quite so comfortable when we read the following: "There must be the stock before the graft; the seed before the plant can develop. Therefore, talk about the attractions of nature and of her beauties, especially of the beauties * * *. Ex-

patiate to your pupils on the beauty of nature." Most of us should be cautioned, I fear, before acting upon this advice, for it is dangerous ground.

The chapter on correlation is good. The world about us is worthy of study in its own right. "There is danger of correlating nature-study until it is annihilated," yet there are lines of intersection that should be followed into other fields. "Correlate manual training with nature-study interests and see how the whole child-life wakens up. You wake him up to one thing and he is awake to all."

The author's sense of humor is not lacking and many of his points are made by the *reductio ad absurdum* method. The book is written in an interesting style, and will doubtless stimulate many readers to a greater interest in direct study of natural things.

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First Principles of Agriculture. By E. S. Goff and D. D. Mayne. N. Y., American Book Company. Pp. 248, illustrated, eight colored plates. 80 cents.

This little book, intended for use in the rural schools, is another evidence of the growing tendency to emphasize the practical element in education, to connect the school life of a child with its home life and daily environment. Written as a text-book for "pupils in the upper form of the rural school," it is an endeavor "to make the farm a center of interest and its industries, its economies, and its science the subjects of thought and study."

The book consists of a series of brief reading lessons on soils, plants and various horticultural operations, insects, dairying and animal husbandry. The earlier subjects are illustrated by simple experiments, the directions for which are given at the beginning of each lesson, while at the end of each is a summary of the chief points covered. The book is illustrated, containing several appeals to the popular taste in the way of colored plates.

For those schools in which a good course in nature-study extending through the earlier years already exists, this book, dealing as a large part of it does with some of the simpler facts of plant and animal life, would seem to be superfluous, since it is not written or arranged in such a way as to be of much use in such an

extended course. On the other hand, in schools in which a study of these first principles of agriculture is introduced into the last year as an entirely new subject, so condensed a text-book would hardly suffice alone to accomplish its avowed purpose. No attempt is made to outline a complete course of study or to give any but the simplest examples of practical work; many topics are omitted altogether or stated briefly as facts without demonstration. It is difficult to see how the book, taken as reading lessons only, could arouse any very vivid interest in the farm as a subject of thought and study. Supplemented, however, by additional practical work, and in the hands of a trained teacher, it might be very useful as a reading book for those classes in which the economic side of nature-study is emphasized.

ADA WATTERSON.

TEACHERS COLLEGE,
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Bird Life Stories. Book I. By C. M. Weed. Chicago, Rand, McNally & Co. 1904. Pp. 86, 24 three-color plates. 75 cents.

This book, which is one of a series of three books now in press, is made up of condensed and revised selections from descriptions of our common birds by Audobon, Wilson, Nuttall and Bendire—our four most famous writers on birds. The slight revisions and condensations of the original descriptions have been made only where it was necessary to omit matter of no modern or general interest and to shorten sentences so as to make the meaning more clear to pupils of the upper grammar grades, for which the book is intended. Notes on geographical distribution have been added to the description of each bird; and each account is accompanied by a plate which is excellent in its truthfulness to form and color. The book presents in a most attractive form just such material as a teacher should be glad to place in the hands of the pupils to supplement their practical work on birds. Teachers and pupils will eagerly await the appearance of the other two volumes.

ANNA N. BIGELOW.

Monarch, the Big Bear. By E. Thompson Seton. N. Y., Scribner's Sons. 1904.

This interesting story deserves notice in a journal devoted to the educational aspects of nature-study not because it has any

close connection with that field; but because it will undoubtedly be so classed, with others of its kind, in the minds of many people. The book is a typical Thompson-Seton contribution to animal fiction; and, of course, it has the characteristic prefatory explanation that "the intention is to convey the known truth," but the legal phrase "nothing but the truth" is wisely avoided in an "historical novel of Bear life." The author admits that it is not exactly a contribution to pure science. But in spite of all such scientific deficiencies the story will find enthusiastic readers. Children—small ones and many of larger growth—will never tire of "bear stories" so long as specimens of these interesting animals remain; and readers who are too old for "The Three Bears" of the nursery days will enjoy even the unscientific parts of this latest account of bear life seen through a strong and healthy imagination. From the standpoint of fiction "Monarch" is splendid; but for real nature-study we prefer the less mighty, but more natural, specimens of the zoological parks. M. A. B.

NOTES ON RECENT PAMPHLETS AND MAGAZINE ARTICLES

Home Nature-Study Course. In this interesting series of correspondence leaflets for teachers conducted by Mrs. Comstock, of Cornell University, five volumes have been completed and No. I of a new series was issued in October, 1904. It contains lessons on Leaf Study; Seed Distribution—Weeds; Chipmunk; Alfalfa or Lucerne. No. 2, December, deals with evergreens; and among other useful points, it gives simple tables for determining our common cone-bearing trees. The leaflets are free to teachers in New York State who follow the course, ten lessons in a year; 25 cents per year to subscribers outside of the state.

"Beautiful America." Under this heading, Mr. J. Horace McFarland, of Harrisburg, Pa., President of the American Civic Association, begins in the *Ladies' Home Journal* for January the second year of a department devoted to beautifying our homes and towns. Leaflets describing the work of the association will be sent to those who apply, enclosing stamp, to the Secretary of the Association, North American Building, Philadelphia. Many

of the educational and social aims of the organization are in general terms so similar to those underlying gardening for children that teachers of nature-study who are local directors of children's gardens ought to get into touch with the work of this national society. In a later issue we hope to review some phases of the work of the Civic Association.

Garden Magazine. A new periodical with this title appeared last month (Feb.), published by Doubleday, Page & Co., New York. It contains many timely articles and notes of interest to those who make gardens primarily for pleasure. It is attractively illustrated. Monthly. $1.00 per year.

Training Teachers at Macdonald Institute. As No. 20 of a series of nature-study papers by Canadian educators, the *Ottawa Naturalist* publishes in the January, 1905, issue (Vol. 18, pp. 193–196) an article on "Nature-study at the Macdonald Institute," by D. J. Doyle, which gives many interesting facts concerning the work of this new training school. It is of special interest to note that, while recognizing the importance of child-study to the teacher of nature-study, the staff of this school insists upon "placing the students as much as possible in direct contact with nature" by means of field excursions and laboratory study.

Report of Children's School Farm. An interesting account of gardening is to be found in a recent pamphlet entitled "Report of the First Children's School Farm in New York City, originated and conducted by Mrs. Henry Parsons." This report is "printed for distribution in answer to the constant inquiries from all parts of the country concerning the details of the work whose great importance Mrs. Parsons was the first person to demonstrate in the city of New York, with the cooperation of the Park Board." It is a very full and satisfactory account of the gardening work directed in the unimproved part of DeWitt Clinton Park (Eleventh Avenue and 52d St.) in the summers of 1902, 1903, 1904; and will doubtless be helpfully suggestive to others who conduct such experiments in densely populated regions of our great cities. From the educational standpoint the Children's Farm is in no essential respect different from many gardens which were developed years ago in other cities; but it is of interest because it is another successful garden developed under very adverse conditions.

History of School-Gardens. A pamphlet, free, with the title "Progress of Agricultural Education, 1903," is a recent reprint from the 1903 Annual Report of the office of the Experiment Stations, U. S. Department of Agriculture. It deals with the progress of agricultural education in colleges and in schools of elementary and secondary grade. Ten pages and eight excellent plates of full-page size are devoted to school-gardens, giving a very useful general history and survey of the school-garden movement in all parts of the United States and the insular possessions. A list of elementary books and pamphlets on nature-study and school-gardening, previously published as Circular No. 52, is here reprinted.

Some Children's Pets. Under this title a recent bulletin of the Northern State Normal School, Marquette, Mich., outlines some nature-study lessons on common animal pets. The lessons are designed to run through the fall term of the first, third, fifth and seventh grades. There is no apparent reason for the arrangement according to alternate grades; on the contrary, many schools do similar work best by concentrating in the first and second grades.

Rhode Island "Nature Guard." No. 33, "Tracks in the Snow," and No. 34, "A Talk about the Weather," No. 35, "How to Grow Corn," and No. 36, "Seed Travelers," are the latest additions in the interesting correspondence series conducted by Professor Card of the Rhode Island College.

Nature Collections. Bulletin No. 134 (June, 1904) of the Ontario Agricultural College, the second leaflet from Macdonald Institute, gives useful hints on making collections for schools. It was prepared by the late Dr. Muldrew. It gives suggestions for collecting (1) nature notes, (2) living animals and plants, (3) pressed plants and leaves, (4) grains and grasses, (5) seeds and dry fruits, (6) specimens of wood, (7) insects, (8) historical objects.

Key to Woody Plants in Winter. A pamphlet with this title has been recently published by K. M. Wiegand and F. W. Foxworthy of Cornell University, Ithaca, N. Y. (Price, 25 cents.) It includes the genera of trees and shrubs found wild or in cultivation in the state of New York, but it also applies to the neighboring states. It appears to be a useful supplement to such a book

as Huntington's "Studies of Trees in Winter" (Boston, Knight & Millet, 1902), which gives good descriptions and illustrations but no key to genera.

Tuskegee Institute Leaflets. Teachers' Leaflet No. 2 gives practicable directions for making gardens. An interesting feature is the "Calendar" which gives planting directions by months. Farmers' Leaflet No. 16 deals with cotton.

GUIDE TO PERIODICAL LITERATURE

A BIBLIOGRAPHY OF THE LEADING MAGAZINE ARTICLES OF INTEREST IN CONNECTION WITH NATURE-STUDY

JANUARY TO SEPTEMBER, 1904

ARRANGED BY ADA WATTERSON

Tutor in Biology, Teachers College, Columbia University

[EDITORIAL NOTE.—This second installment of the bibliography completes the record for the first eight months of the year 1904.

It has not been attempted to make a complete bibliography; but rather to select those articles which appear to be most important and accessible in most public libraries. In the case of periodicals designed for local circulation, only articles of exceptional merit will be catalogued.

The figures with black face indicate the volume and those following the : refer to the pages. The abbreviations of journal titles and dates are those used in the general indexes to be found in libraries.

Readers are requested to inform the compiler concerning any important omissions.]

2. NATURAL HISTORY OF ANIMALS AND PLANTS

I. GENERAL

Bigelow, E. F. (ed.) Nature and science. Dept. in St. Nich. **31.** 1904. Nature pedagogy. Dept. in Pop. Educator. **21.** 1904.

Blight, R. (ed.) Among the plants; garden, field and forest. Cur. Lit. **36.** Ja.–Ap. '04. Nature in and out of doors. Cur. Lit. **36.** My.–S. '04. (Extracts from various current magazines.)

Comstock, Anna B. Nature study. Dept. in Chaut. **39.** Ja.–Je. '04. (Lessons on animals and plants.)

Weed, C. M. Seasonable nature studies. Serial in Jour. of Educ. (New Eng.). **59.** Ap.–My. '04. (Studies of birds and flowers.)

II. ANIMALS (GENERAL)

Bigelow, E. F. Comfort in cold weather. St. Nich. **31**: 360–2. F. '04. (Winter homes of animals.)

Burroughs, John. Animal individuality. Ind. **56**: 85–87. Ja. 14, '04. Current misconceptions in natural history. Cent. **67**: 509–17. F. '04. Natural History. Dept. in Outing, beginning Ap. '04. Some natural history doubts and conclusions. Harper. **109**: 360. Ag. '04. What do animals know? Cent. **68**: 555–63. Ag. '04.

Flint, A. Tact and taste in animals. Sci. Am. S. **57**: 23444–5. Ja. 16, '04. How animals detect poison. Sci. Am. S. **57**: 23751. My. 28, '04.

Long, W. J. Animal Individuality. Ind. **56**: 1242–8. Je. 2, '04.

Smith, N. A. Children's pets. Kind. Rev. **14**. Ja. '04.

Invertebrates, Except Insects

Brewster, E. T. Root-footed animals. St. Nich. **31**: 552–4. Ap. '04. (Protozoa through the microscope.)

Conn, H. W. Jellyfishes. St. Nich. **31**: 963. Ag. '04.

Furlong, E. E. Warrior mound-builders. St. Nich. **31**: 651–2. My. '04. (Crayfish.)

M'Clure, W. F. Starfish and their injuries. Sci. Am. **90**: 98. Ja. 30, '04. (Habits and forms.)

Miller, E. R. Odd things which live in the sea. Overland. **44**: 71. Jl. '04.

Rogers, J. E. Common shells of the seashore. C'try Life in Amer. **6**: 246–9. Jl. '04.

Insects

Aaron, S. F. Effect of cold on insects. St. Nich. **31**: 362. F. '04. The mosquito. **31**: 648–50. My. '04.

Collins, P. Protective resemblance of insects. Sci. Am. S. **57**: 23764–5. Je. 4, '04.

Comstock, A. B. Ants. Chaut. **39**: 273–6. My. '04. The bumblebee. **39**: 384. Je. '04. The mourning-cloak. **39**: 76. Mr. '04.

Fulda, G. Examples of insect mimicry. Sci. Am. **91**: 219. S. 24, '04.

Higginson, T. W. Butterflies in poetry. Atlantic. **93**: 746–54. Je. '04.

Howard, L. O. Mexican cotton-boll weevil. R. of Rs. **29**: 188–91. F. '04.

Hutchinson, C. E. A trapdoor spider. Sci. Am. **91**: 83. Jl. 30, '04.

McCook, H. C. Aëronautic spiders. Harper. **108**: 905–11. My. '04. Insect commonwealths. **108**: 554–60. Mr. '04. Tailoring animals. **108**: 453–7. F. '04. The daintiness of ants. **109**: 604–10. S. '04. The strange cycle of the cicada. **109**: 44–49. Je. '04.

Marlatt, C. L. Discovery of the native home of the San Josè scale in Eastern China and the importation of its natural enemy. Pop. Sci. Mo. **65**: 306. Ag. '04.

Miller, E. R. American silk-worm moth. Overland. **43**: 510–11. Je. '04.

Snyder, C. D. Do grasshoppers drink? School Science. **4**: 90–2. My. '04.

Spectator. Bee-keeping. Outlook. **76**: 208–10. Ja. 23, '04.

The bee as an artisan. (Trans. fr. La Nature.) Sci. Am. 91: 98. Ag. 6, '04.

Winter insects. Sci. Am. 90: 150. F. 20, '04.

LOWER VERTEBRATES

Burti, V. How a python eats. Sci. Am. 90: 31. Ja. 9, '04.

Forbes, R. P. Fish of the western sea. Overland. 43: 176–80. Mr. '04.

Knight, C. R. Color in Bermuda waters. Cent. 68: 595, 603. Ag. '04. (Adaptations of fishes to their surroundings.)

Smith, H. M. "As flat as a flounder." St. Nich. 31: 1032. S. '04.

Spaid, A. R. M. Harmless reptile. Sci. Am. 90: 47. Ja. 16, '04. (Lizards.)

Stockton, F. R. Alligator hunting. St. Nich. 31: 335–40. F. '04.

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Beasley, W. L. The flamingo and its queer nest. Sci. Am. 91: 66. Jl. 23, '04.

Birds and the farmer. Ind. 56: 1041–2. My. 5, '04. (Economic value.)

Burroughs, John. Nature's way. Harper. 109: 263. Jl. '04. (Birds' nests.)

Comstock, A. B. The brown creeper. Chaut. 38: 593. F. '04. The chipping sparrow. 39: 173–5. Ap. '04. White-breasted nuthatch. 38: 491–3. Ja. '04.

Dawson, F. A. Bird walks for children. Harp. B. 38: 154–62. F. '04. (Field work for small children.)

Finley, W. L. Rearing a wren family. St. Nich. 31: 735–41. Je. '04.

Garland, V. A California minstrel (mocking-bird). Overland. 43: 118–20. F. '04. Feathered Californians. 43: 386–7. My. '04.

Gleeson, J. M. The great horned owl. Outlook. 77: 295–7. Je. 4, '04. The harpy eagle. St. Nich. 31: 832–3. Jl. '04.

Hawson, F. E. When the birds were our guests. St. Nich. 31: 906. Ag. '04.

Herrick, F. H. Modern scientific methods of nature-study. Harp. W. 48: 53, 57–8. Ja. '04. (Photographing birds.)

Hoar, G. F. The birds' petition. Educ. Gaz. 20: 145. My. '04. (Petition to Mass. State Legislature for protection of birds.)

Job, H. K. Great Cuthbert rookery. Outing. 43: 583–90. F. '04. On lonely Bird Key. 44: 231–8. My. '04.

Oldys, H. Basket of chips. Atlantic. 93: 219–25. F. '04. (Bird song.)

Palmer, F. H. Song-sparrow. Educ. 24: 500. Ap. '04. (Birds in poetry.)

Rogers, C. E. Our friends, the birds. Ed. Gaz. 20: 144. My. '04.

Sandys, E. Robbing birds' nests. Outing. 44: 387. Je. '04.

Sharp, D. L. A crazy flicker. St. Nich. 31: 554–5. Ap. '04.

Smith, T. C. Song-forms of the thrush. Atlantic. 93: 777–86. Je. '04.

Spectator. Food of birds. Outlook. **76**: 158–60. Ja. '04.

Stewart, J. A. Arbor and bird day exercises. Jour. of Educ. **59**: 135. Mr. 3, '04.

Scott, W. E. D. Blue jays. Outlook. **77**: 45. My. 7, '04.

W., G. E. New study of bird life. Sci. Am. **90**: 22–23. Ja. 9, '04. (Care of wild birds in winter.)

Wolcott, R. H. Outline of bird study. Jour. of Educ. **59**: 245, 278. Ap. 21, My. 5, '04.

Van Dyke, T. S. When the graywings came. Outing. **43**: 667–72. Mr. '04.

MAMMALS

Beard, J. C. Snow houses of the seal and of the bear. St. Nich. **31**: 210–11. Ja. '04.

Boyden, A. C. Domestic animals. Squirrels and rabbits. Perry Mag. **6**: 225. Ja. '04. Beasts of burden. **6**: 305. Mr. '04.

Chapman, A. Pariah of the skyline. Outing. **44**: 131–8. My. '04. (Coyote.)

Eastman, C. A. Gray chieftain. Harper. **108**: 882–7. My. '04. (Story of a Bighorn ram.)

Gilman, C. Monkeys. Jour. of Educ. **59**: 38, 54, 87. Ja. 21, 28, F. 11, '04. The elephant. **59**: 118, 182. F. 25, Mr. 24, '04.

Gleeson, J. M. "Bhalu"—the Indian jungle bear. St. Nich. **31**: 712. Je. '04. Grizzly bear. **31**: 408–9. Mr. '04. The coyote. **31**: 606–7. My. '04.

Harcourt, H. Stories of my pets. St. Nich. **31**: 898. Ag. '04.

Humphreys, P. W. Animal ship. St. Nich. **31**: 304–9. F. '04. (Wild animals from Africa.)

Lydekker, R. How baby bats are nursed. (Abstract.) Sci. Am. **90**: 192. Mr. '04.

McGrath, P. T. Wonderful whale-hunting by steam. Cosm. **37**: 48–56. My. '04.

Rolker, A. W. Wild-animal surgeon and his patients. McClure. **22**: 235–44. Ja. '04. The rogues of a Zoo. **23**: 212. My. '04.

Scott, W. E. D. My dog Grouse. Outlook. **77**: 304. Je. 4, '04.

Seton, E. T. The master-plowman of the West. [Gophers as soil-formers.] Century. **68**: 300–307. Je. '04. Monarch, the grizzly. Ladies' H. J. **21**: 5–6. F. '04. Little Warhorse: the story of a Jack-rabbit. Ladies' H. J. **21**: 13–14. Je. '04.

Smith, H. M. Largest animals. (Whales.) St. Nich. **31**: 456–9. Mr. '04.

Spectator. Bloodhounds. Outlook. **76**: 776–8. Ap. 2, 1904.

Swindlehurst, F. Day with the Eskimo seal hunters. World's Work. **7**: 4331–5. Ja. '04.

Whitney, C. Jin Abu finds an elephant. Outing. **43**: 558–71. F. '04.

III. PLANTS (GENERAL)

Anderson, M. P. The protection of our native plants. Plant World. **7**: 123–29. My. '04.

Apgar, E. A. Reproduction in plants. Harper. 108: 713–20. Ap. '04.

Broadhurst, Jean. The protection of our native plants. Plant World. 7: 152–54. Je. '04.

Comstock, A. B. Food stored in seeds. Chaut. 38: 493–6. Ja. '04. Sugar bush. 38: 590. F. '04. The clovers. 39: 384–90. Je. '04. The onion. 39: 276. My. '04. The potato study. 39: 76. Mr. '04. The skunk cabbage. 39: 76. Mr. '04. The trilliums. 39: 173–5. Ap. '04.

French, F. Nature's jewel caskets. Outing. 43: 409–13. Ja. '04. (Seed dispersal.)

Gardner, H. G. Creating new fruits. Cosm. 37: 262. Jl. '04. (Work of Dept. of Agric.)

Harwood, W. S. A maker of new plants and fruits. Scrib. 36: 49–55. Jl. '04.

MacFarland, J. H. Nut-bearing trees. Outlook. 76: 597–607. Mr. 5, '04. Some American trees. 76: 817–27. Ap. 2, '04.

Mackenzie, M. Open secrets. Kindergarten Review. 14. Ja. '04. (Trees in winter.) Familiar trees and their flowers. 14. Mr. '04.

Shreve, F. Some plants which entrap insects. Pop. Sci. Mo. 65: 417–31. S. '04.

FORESTRY

Planting forests. Ind. 56: 392–4. F. 18, '04.

Forest reserve for New England. Harp. W. 48: 228–9. F. 13, '04.

Munn, M. J. Great industries of the United States. III. Lumber. Cosm. 37: 437–450. Ag. '04.

Perceval, H. Maple sugaring in the northern woods. Outing. 44: 36–44. Ap. '04.

Pinchot, Gifford. The new hope for the West. Cent. 68: 309–312. Je. '04. (Forestry reserves in the West.) Life of a forest. Sci. Am. S. 57: 23766–7. Je. 4, '04.

Roosevelt, Theodore. Our forest policy. (Address to Soc. of Amer. Foresters, Mr. 27, '03.) Extracts in Plant World. 7: 8–11. Ja. '04.

Vandevoort, L. Uncle Sam's foresters. Outing. 43: 629–32. Mr. '04. (Field work of Div. of Forestry.)

3. AGRICULTURE, INCLUDING GARDENING

Bailey, L. H. A children's garden. Amer. Jour. of Educ. 37: 297–8. Ap. '04.

Bennett, H. C. School gardens in great cities. R. of Rs. 29: 439–43. Ap. '04.

Bigelow, E. F. An egg-shell garden. St. Nich. 31: 1035. S. '04. Plants as pets. School Science. 4: 87–90. My. '04.

Bowles, J. M. A flower-garden for every child. World's Work. 8: 4799–4803. My. '04. (Home Gardening Assoc. of Cleveland.)

Davenport, E. Study of Agriculture. Dept. in School News. 17. '04.

Davis, F. My first greenhouse. Ind. **56**: 1378–81. Je. 16, '04.

Falconer, W. Gardening department in Ladies' H. Jour. **21**. '04. Gardener's midsummer calendar; insecticides. **21**: 26. Jl. '04.

Galloway, B. T. Farming under glass. World's Work. **7**: 4583–8. Mr. '04. Profits of garden and orchard. **7**: 4419–24. F. '04.

Hay, W. P. A miniature conservatory in a city home. C'ntry Life in Amer. **5**: 249. Ja. '04. (Suggestions useful for schoolroom.)

Knapp, G. R. Winter house plants. Harp. B. **38**: 79–81, 207–8. Ja., F. '04.

Knowlton, F. H. (ed.) Garden and greenhouse. Dept. in Plant World. **7**. '04.

Laidlaw, M. C. School gardens. Kind. Rev. **15**: 12–17. S. '04.

Macleod, Ward. Ferns within doors and without. Delin. **63**: 330–2. F. '04. Dept. in Delineator. **63**. '04.

Moore, G. T. Bacteria and the nitrogen problem. Sci. Am. S. **57**: 23508–10. F. 13, '04.

Paine, A. B. Little garden calendar. Dept. for children in Delin. **63**. '04.

Richards, R. Bog plants. New Eng. M. **30**: 419–23. Je. '04. (Plants which could be transferred to school-gardens.)

Shaw, Adele M. Common-sense country schools. World's Work. **8**: 4883–95. Je. '04. (School grounds.) The ideal schools of Menomonie. World's Work. **7**: 4540–4553. Mr. '04. (School gardens.)

Stableton, J. K. How school gardens are carried on. School and Home Educ. **23**: 308. Ap. '04. Winter preparation for school gardening. **23**: 216. F. '04.

Sutherland, A. Beauty for ashes. Delin. **63**: 648–9. Ap. '04. (Vacant Lots Cultivation Assoc. work in Phila.)

Weed, C. M. (ed.) The home garden. Dept. in House Beautiful. **15**. '04.

Plant food from the air. Sci. Am. S. **57**: 23413. Ja. 2, '04. (Nitrogen problem.)

Scientific basis of cheese-making. Pop. Sci. Mo. **64**: 383–4. F. '04.

4. GEOGRAPHICAL NATURE-STUDY

Burrows, A. T. Cyclones, tornadoes and hurricanes. St. Nich. **31**: 949. Ag. '04.

Fairbanks, H. W. Something about rock salt. St. Nich. **31**: 841. Jl. '04.

Meteorology for little folks. Amer. Jour. of Educ. **37**: 241–2. Mr. '04.

Meyers, I. B. Elementary field work. Elem. Sch. Teacher. **4**: 312. (Physiographic work, including some ecology.)

Wygant, E. A. Work with minerals for little children. Ele. Sch. Teacher. **5**: 36–49. S. '04. (Lessons given in Univ. of Chicago School of Education.)

5. PHYSICAL NATURE-STUDY

Brewster, E. T. Radium. St. Nich. 31:746–8. Je. '04.

Culler, J. A. Experiments with the pendulum. Reprint in Amer. Jour. of Educ. 37:283. Ap. '04.

Woodhull, J. F. Physical nature-study. Sch. Jour. 68. Ja. 9, Mr. 12, '04. Physical nature-study. Sound. Jour. of Educ. 59:70, 102. F. 4, 18, '04.

NEWS NOTES

Conference on Nature-Study. Under the auspices of the Seminary for the the Study of Special Problems in Education, a conference on nature-study in the elementary schools, with especial reference to the study of agriculture, was held at the University of California, December 10th. Resolutions were proposed relating to the encouragement of such studies through legislative provision for a Central Bureau of Information, for special training of teachers and supervisors, and for the appointment of supervisors to act as deputy county superintendents of schools. Appropriate bills will be presented to the legislature.

Garden Seeds. The Home Gardening Association, 369 St. Clair St., Cleveland, Ohio, is extending its work of furnishing seeds at one cent a packet to schools and other organizations outside of the city. When this note reaches readers it may be too late to obtain seeds for this season, but those interested should send a two-cent stamp for circulars which explain the methods of carrying on this important work. Fuller accounts of the work will be found in the illustrated annual report for 1904; price 25 cents.

Dean of Macdonald Institute. To this position, made vacant by the death of Dr. Muldrew, Professor S. B. McCready, science master in the Collegiate Institute of London, Ontario, has been appointed.

Chicago School-Gardens. On September 10, 1904, the 250 principals of the schools of Chicago decided to beautify their schools by planting trees, shrubs and vines, and by establishing flower gardens in the schoolyards and window-boxes in the schoolrooms. The Board of Education will be called upon only to provide the soil, the work will be done by teachers and pupils.

Philadelphia School-Gardens. In May, 1904, the city council appropriated the sum of $3,500 to establish and maintain school-gardens in that city from May 15 to October 15. The work was in charge of the Educational League, and the gardens were superintended by Miss H. C. Bennett.

Summer Courses for Teachers of Nature-Study. Circulars or letters giving information are wanted for use in preparing the "News Notes" for the May number of THE REVIEW.

The date of publication of this journal is planned for the 20th of January, March, May, etc.

NEW BOOKS RECEIVED

House, Garden and Field. A collection of short nature studies. By L. C. MIALL. London; Arnold (N. Y., Longmans, Green). 1904. Pp. 316, figs. 57. $2.00.

New Elementary Agriculture. An elementary text-book for rural schools. By C. E. BESSEY, L. BRUNER, G. D. SWEZEY. Lincoln, Neb.; University Pub. Co. 1904. Pp. 194, figs. 60. 75 cents.

Organic Evolution. By M. M. METCALF. N. Y.; Macmillan. 1904. Pp. 204, 101 full-page plates, 50 figs. $2.50. (One of the best books for general readers who want an introduction to the subject.)

A Health Primer. By W. M. COLEMAN. N. Y., Macmillan. 1904.

First Book in Hygiene, and **Graded Lessons in Hygiene.** By W. O. KROHN, N. Y.; Appletons. 1904.

Mary's Garden and How it Grew. By FRANCES DUNCAN. N. Y.; Century Co. 1904. Pp. 261, illustrated. $1.25. (Simple directions for gardening and information about plants and their life, in story form, for children between five and ten years.)

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Vol. 1, No. 3 May, 1905

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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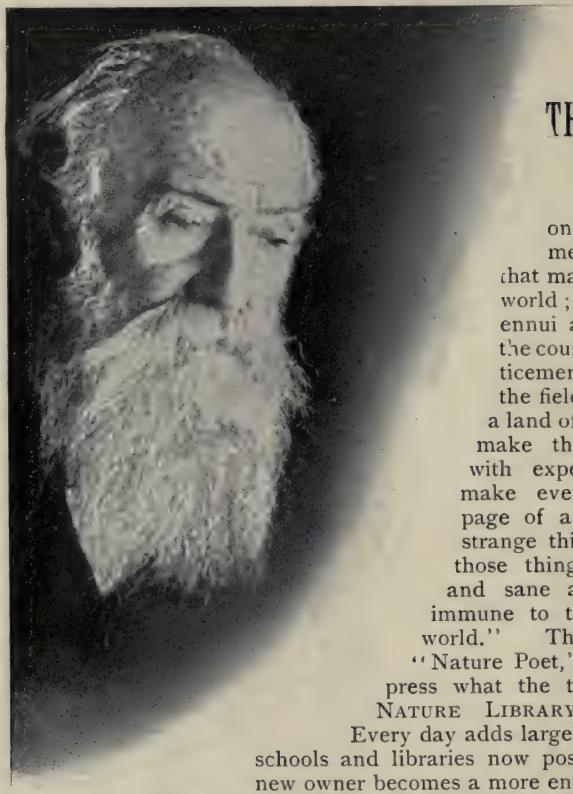

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NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

VOL. I MAY, 1905 No. 3

WHY MANY FAIL IN TEACHING NATURE-STUDY

BY LUTHER A. HATCH

Principal of Training School, Northern Illinois State Normal School

Many fail because they are not prepared for the work. There are those who seem to think that anyone who can teach other subjects in the grades can teach nature-study. It must be remembered that occasionally a teacher is found who is born so short along this line that it is a mistake to expect her to do anything at the work. Nature has not blessed her with keen observation; she scarcely ever thinks of the many problems in nature about her. Her interests lie along other lines. Her stock of information and her disposition to inform herself are limited. She sees nothing to teach her pupils. She does not possess the patience to search out problems and to carry on, for an indefinite time, observations which lead to the discovery of scientific truths. The spirit of investigation is foreign to her thought. She cannot acquire it or cause others to do so. How can one with this mental endowment make a success in teaching nature-study.

To succeed one must be filled with a love for nature and have a desire to know more of her. One such will go out in the early morning, at noonday and in the twilight and listen to her teachings, and return to the schoolroom filled with new life, bearing rich things for the pupils. In turn the pupils will catch the infection and will make their little journeys and glean rich harvests.

Again, teachers fail to discriminate between the essential and the non-essential in their teaching. Oftentimes the trivial, the unimportant, receives as much attention in the recitation as that of genuine importance. Pupils are left in the dark as to the

relative value of what they have been studying. This is poor teaching. The teacher should not ramble anywhere in her work as fancy or the whims of her pupils dictate, but she should study her subject-matter and her pupils, so that essential truths may be made to stand out in the recitation like mountain peaks against the clear sky. This clear-cut teaching can be done in nature-study as well as in other studies. While flexibility in a course of nature-study is a thing desired, there is no reason why looseness in one's method in the recitation should be tolerated.

Nature-study as often taught has a tendency to make of the pupils the most expert of liars. The writer visited a third-grade recitation a few days ago. The teacher asked, "How many have seen a fir tree?" Up came nearly every hand in the class. The writer doubts very much if a single member of the class ever saw a fir tree. On a cold winter day a teacher asked, "What kind of an eye has a toad?" Before the pupils got through the toad had a very peculiar assortment of eyes. A teacher asked, "How many have seen any young red-headed woodpeckers this Spring?" In a short time a boy who knew how to "work" his teacher had a post actually alive with red-headed woodpeckers projecting their heads out of knot-holes. His principal happened to enter and suggested that the boy go with him after school to the post in question. The boy's memory grew dim as to where the post was located; he finally said that he did not see it but that his sister did and told him. In the end he had to admit that he made up the story for the occasion. In the same recitation there were several other similar stories, all produced because the teacher urged something, because she accepted whatever was given her, and because pupils had discovered that they could fool her. The teacher must know what pupils should see and be a skilled questioner to head off this tendency to see things that do not exist and to image things that cannot be. The habit of truthfulness needs to become a part of the pupil's training or one of the great lessons gained through nature-study will be lost.

Quite a common pedagogical blunder is committed by the nature-study teacher in forcing conclusions upon her pupils. It often comes about in this way: The teacher has thought through her subject-matter; she has made her observations and reached her conclusions; everything seems clear to her mind. Why should it not be clear to her pupils? This she assumes to be the case

and upon this basis doles out her generalizations, forgetting that they may be worse than meaningless to her pupils when gained by them in this unnatural way. For some teachers it is easier to think for pupils than it is to get them to think for themselves. Such teachers are better at teaching their subjects than they are at teaching pupils. They wonder why it is necessary to teach again a subject that has once been presented clearly. Pupils must do their own thinking and reach their own conclusions if they are to be of any value to them. Above all things the teacher of nature-study needs to cultivate open-mindedness on the part of her pupils. They must be ready to change conclusions previously reached, if further investigation and thought demand that the change be made. They need to learn to base judgment upon reliable evidence. They need to know what to class as reliable evidence. They need to be discouraged in basing conclusions upon insufficient data. Right here it is hard for some teachers to go slowly. They are in such a hurry to tabulate and pigeonhole every scrap of knowledge that the child has that they can't wait to let the child do some of this work for himself later in life when there is a necessity for it.

Nature-study is peculiar in that the material dealt with, for the most part, is at first hand. This being true the teacher who tries to teach this subject without sufficient suitable material on hand, or within the reach of the child when it is needed, misses the pith of the whole matter. There is a pathetic side to nature-study which manifests itself, for instance, when a teacher stands before her class with a dead apple twig six inches in length in her hand and attempts to teach her pupils about the apple bud and how it is fitted to be protected during the winter. The humor of the situation becomes apparent when the class is studying life and it is largely done through the study of dead specimens of plants and animals. As a rule dead plants and animals do not manifest life. Pupils are intensely interested, generally, in the study of life under different forms and conditions. About it the most interesting of problems cluster. These problems suggest to us an ideal method of instruction. When we can present our work to our pupils in the form of a problem, or a series of related problems, we have solved in a large measure the problem of teaching. These problems are found in the material of nature-study, hence the importance of having that material at hand when

it is needed in the process of education. It need not be implied by what has been said that the child must always be wallowing up to his ears in material. There are times when he should depend upon what has been observed. However most teachers will err by not having enough material on hand when it is needed, rather than by having too much.

Again, there are teachers who seem to think that they must develop everything in nature-study. The recitation resolves itself into a pumping process. The operator works hard and overtime at this educational pump, with now and then a spasmodic wheeze as a result. The well is dry. The pump is primed with questions at the rate of one hundred during a twenty-minute recitation. The result is a crop of stories made up to fit the demand. Others go fishing for ideas, using every kind of bait known to the pedagogical angler. Occasionally a nibble gives hopes to the fisherman and he feels certain that he is about to land an educational trout, but as he reels in his line he finds that he has nothing but a bunch of weeds from the bottom of the stream. There is no use fishing where there are no fish.

Occasionally a teacher gets the idea that nature-study teaching consists in carrying on, before her class, a series of entertainments along the line of experiments, something of the pyrotechnic order. If these are carried on long enough pupils will lose interest in the more common things about them and hunger for a show when the nature-study period arrives. There are times when these experiments are just the thing, but as a rule an experiment is a difficult thing for the child mind to comprehend because nature is tampered with and the child cannot see the setting of what takes place. It is quite essential that we cultivate in the child the right mental attitude for the common things about him and that he comes to see in them that which is worthy of his attention.

READY-MADE LESSONS IN NATURE-STUDY

BY L. C. MIALL, F.R.S.

Professor in the University of Leeds and in the Royal Institution

[EDITORIAL NOTE.—The article below is an extract from the introduction to Professor Miall's "House, Garden and Field" (London, Arnold; New York, Longmans) which will be reviewed in the next issue of THE REVIEW. It deserves re-publication here for the reasons that perhaps a majority of readers are prone to overlook prefaces to books and, at any rate, the book in this case will not be accessible to a very large number of the readers of this journal.]

I have received a good deal of advice from teachers and others as to the kind of book on nature-study that is really wanted, and I will begin by explaining how it is that I have found it undesirable to attempt exactly what my friends expect. They expect, it would seem, ready-made lessons on a variety of interesting and easy topics. The teacher, they tell me, has neither the time nor the knowledge to prepare lessons of his own. Since lessons on nature-study are demanded, they must be drawn up for him, and put into his hands complete. It is quite true, I sorrowfully admit, that many teachers have no time for study. That is almost the same thing as admitting that they have not time to teach well, for it is only those who are always increasing their own knowledge who can hope to become inspiring teachers. Knowledge, to be stimulating, must be kept alive by personal effort; it cannot be acquired once for all.

This is true, I believe, of all teaching, but it is especially true of nature-study. For the primary aim of nature-study is to set up the habit of observation, and to keep alive that love of nature which shows itself in most unspoilt human beings. If the teacher does all the observation himself, his pupils are defrauded of their fair share, though they may possibly catch something from him of the spirit of inquiry. But if the teacher too gets all his knowledge without effort, then the so-called nature-study which he dispenses has no more power to excite the love of nature or the spirit of inquiry than a printed list of the kings of England with dates. These considerations lead me to believe that it will be a greater service to start, if I can, the habit of observation and inquiry in some few teachers than to furnish a great many ready-made lessons.

I do not, however, think it superfluous or mischievous to print from time to time examples of ready-made lessons. The most independent of teachers can profit by seeing how another man goes to work; and he will, it is to be hoped, be as solicitous to note faults which he is to avoid as merits which he is to imitate. Of course, the facilities thus afforded will be abused by some. There are persons in all professions whom no pressure of circumstances would induce to think for themselves. But a teacher of any spirit will at least throw the information and the hints which he gets from another into a form of his own, and will carry on many inquiries which cannot be expected to issue in school-lessons.

The belief is prevalent that the training of teachers in nature-study means supplying them with a number of lessons which can be directly reproduced in the schoolroom. Several objections to this time-saving method force themselves upon the attention. The teachers are put into a servile attitude; they are made into vehicles for transmitting (no doubt with much dilution and some loss of accuracy) lessons which another person has drawn up. The lessons as given to the teachers are not real lessons, nor are the teachers really trained, for the laying up in a note-book of materials for future lessons does not deserve the name of training. A printed book would answer the purpose in view better than any lecture; the book is both more extensive and more accurate than any old lecture-notes. I have understood my duties differently, and address a class of teachers in training as persons whose powers are to be cultivated. Such tasks are assigned to them as they are fit for; the explanations and questions are adapted to their present knowledge and capacity. To offer them a lesson suitable for a class of children would be impossible, and even if it were possible, would give a wrong notion of what the lesson should aim at. A lesson at its best is an inquiry, worked out between the teacher and his class. Train the teachers to observe, to reflect, to express their meaning in clear language, and to arrange the matter of their lessons in a good order, but leave them entirely free to choose their own subjects, and to handle them in their own way.

Though the teacher, even if fortunate, cannot expect to be able to devote a large part of his time to study, the hours that he can now and then spend in study will be of great use, both to him and

to his pupils. If he is only able to get up with due thoroughness a single new lesson a year, that lesson will influence all the rest. I have heard of a schoolmaster who had mastered by his own efforts the movements and phases of the moon, and taught that one thing heartily and well. No mean result, I thought, but I should have been glad to hear that he was adding a fresh topic to his stock every year; less than that would not fix him in the right attitude.

Whether the living things that share our dwellings, or seek their food in our gardens and fields, make the best possible matter for school-lessons or not, the student of nature is bound to attend to them. They are what the mother-tongue is to the student of languages, what the fatherland is to the student of history. A man who knows nothing about the flowers of his own window-boxes and his own flower-beds, nothing about the plants which raise food for him, or the insects which devour what he had hoped to enjoy, nothing about the minute forms of life which bring fertility to the soil, or fatal disease to the household, nothing about house-flies and hive-bees and bacteria—such an one may call himself a naturalist, may indeed have a right to the name, but he has need of deep knowledge of some other kind to escape the accusation of blindness and indifference. What opportunities of enlarging his knowledge of life has he allowed to escape him!

We want fresh helpers for the preparation of new nature-studies. There must be a large number of teachers who could now and then write a good one. The difficulty (and a very serious difficulty it is) would be to pick out the really useful lessons from the rest. Such questions as follow might be some guide in the estimation of merit.

Has the writer made out anything, great or small, that was not known before? Does he employ new methods of inquiry, or new methods of teaching? Is the plan of the lesson natural, attractive, and likely to aid the memory? Is the language simple and expressive? Can the pupils do work for themselves upon the subject of the lesson? Does the lesson contain any good experiment? Is it illustrated by new and careful drawings?

I am quite sure that there would be no difficulty in getting any lesson published which came out well from such an interrogation, and I believe that to write once in a way with all possible care

a lesson which was to appear in print would be a valuable discipline for the more ambitious of our young teachers. I should like to see the preparation of new nature-studies organized a little.

FLOWER SHOWS IN CITY SCHOOLS

BY ALICE R. NORTHROP

Lecturer on Botany and Nature-Study, New York City

In many parts of New York City are children who never see any growing thing—children to whom the world of trees and birds, flowers and brooks, is a sealed book. Nature-study has finally won a place in the school-curriculum, but where to get the "nature" to study is often a most difficult problem. The ideal way is to take the children to the woods and fields; but except in a few instances, this cannot be done under existing conditions. The work briefly described below suggests one way in which the gap between the children and nature may be bridged, at least occasionally.

While visiting a "Wild-Flower Show," given by the Storm-King Club of Cornwall, N. Y., in 1893, it occurred to the writer that here was a plan that might be profitably transported to the city. Accordingly, the following spring a wild-flower show was given in the library of the New York City Normal College by the Natural Science Committee of the Associate Alumnae, of which committee the writer was then chairman. The members of the committee and their friends collected the flowers, of which over one hundred species were on exhibition, all classified and labelled. This we believe was the first wild-flower show ever given in New York City. The College students, the children of the adjoining Training School, the pupils of neighboring schools, and many adult visitors greatly enjoyed the exhibition. It was so successful that six more were given under the same auspices between 1894 and 1900.

As the exhibitions became better known, many more teachers wanted to bring their children, even from distant parts of the city. But the children to whom the flowers would be the greatest revelation were just those who could not afford the necessary car-fare. In order to reach these, permission was secured from the proper

authorities in 1900 allowing us to give the exhibitions in the public schools. Their scope was widened and garden flowers as well as fruits and vegetables were included. The Public Education Association now took an active interest in the work and appointed a Nature-Material Committee, to whose helpful coöperation much of the success of the exhibitions is due.

From 1900 to 1903 three flower shows were given each year. The first was held early in May so that Arbor Day would be included, and special efforts were made to have the trees largely represented. A second spring show was given two or sometimes three weeks later, when not infrequently nearly two hundred kinds of flowers were on exhibition; and a fall show was held about the middle of October, when fruits and vegetables formed a prominent part of the exhibits. In December of 1903 a fourth or midwinter exhibition was given of such miscellaneous material as could be collected at that season of the year or kept over from the summer; for example, birds' nests, wasps' nests, cocoons, galls, shells, starfish, lichens, woody fungi, budding twigs and evergreens. The experiment proved a success and so evidently filled a need of the schools that the plan was continued and a second midwinter show has just been given. This was found to be so helpful that, at the general request of principal, teachers and the district superintendent, it was kept open for ten days in order that the children and teachers of the neighboring schools might profit by it. Being given in a building used as a Girls' Recreation Center, it was open evenings as well as by day. In all, seven exhibitions have been given in the schools, each time in a different building but always in sections where work of this kind is most needed and where we find principal and teachers willing to coöperate with us.

As a rule, the only available space for the exhibitions is a portion of the playground on the ground floor. Saw-horses and planks, kindly provided by the Supply Department of the Board of Education and sent from school to school as they are needed, furnish the necessary tables. As flower-holders we use all the pails, jars, pitchers, etc., available in the building, supplemented by vessels of all sorts and kinds, proudly loaned by the children, who like to feel that they are helping.

While we strive to make the exhibitions as attractive as possible from the artistic standpoint, still, as has been said, their

main purpose is educational and we want the little visitors to carry away something besides the impression of beauty. Hence all the specimens are distinctly labelled with the common names (we now use permanent tin labels with black lettering). The wild flowers and the cultivated plants are arranged on separate tables, and when our specimens warrant it, the former are grouped as the "flowers of the field," "flowers of the woods" and "flowers of the swamps," the first mentioned having when possible a background of common grasses. The flowers producing edible fruits have a table by themselves with specimens showing the young fruit forming. Another table is given up to the lower plants. Here are lichens, fern clumps springing out of velvety moss that the children delight to feel, and there are often horse-tails, club-mosses and colonies of puff-balls that the children never tire of "making smoke." Several times we have had a miniature swamp or bog with pitcher-plant, cranberry vines and sphagnum-moss surrounding a tiny pool (in a tin basin), in which a small turtle and some tadpoles disported themselves. In the fall we have an array of nuts in their shells and other fruits arranged according to their method of dispersal.

It takes at least half a day to arrange the exhibits, and it has not been found possible to keep the flowers more than three days or four unless much fresh material is sent in. The principal of the school divides the available time among his classes. It has been found that the children gain much more when they see the flowers two or three times and have an opportunity to talk them over with each other and with their teachers. At the first visit they are too much overwhelmed to take in details.

That there was great need of just this kind of work the following statistics, based on data carefully collected by the teachers and principals, certainly goes to prove. It was found that in one school, with an attendance of 1,353, 76 per cent of the children had never been to the country; and in another, with an attendance of over a thousand, the percentage was 36, while half the pupils had never seen even Central Park. In another school, 30 per cent of the 932 children in attendance had never been out of the city; in a second the percentage was 67; while in still another it was 40. In two instances we were told by the principal that she fully believed there were children in her school who had never seen grass growing.

As a natural consequence of the above conditions, we found that many of the children did not recognize the most common flowers, either wild or cultivated. For instance, out of a class of 55, Grade 1 B, only a single child knew a clover blossom; of a class of 52, Grade 2 A, four did not know a daisy, seven a buttercup and twelve a dandelion; of a class of 34, Grade 4 B, comprising children from ten to fourteen years of age, three did not know a daisy and twelve a dandelion, though doubtless all of them could recite poems about the flowers in question. I am pleased to be able to state that every child in this school had either daisies or buttercups to take home and become acquainted with. Examples of this kind might be repeated indefinitely. Suffice it to add that marigolds as well as dogwood, apple blossoms and many others were indiscriminately called "roses," and that ferns were invariably termed "soup greens" by numbers of the children. That the children's knowledge of common animal forms was quite as limited was unexpectedly shown by the following incident. A "brown bear" caterpillar chanced to arrive in a box of autumn flowers and was taken by the principal through most of the class-rooms. It proved to be unknown to the great majority of the pupils, who variously called it a "frog," "lizard," "snake," "grasshopper" and "worm." Yet apparently every child, when told what it was, could glibly inform us that a caterpillar turns into a chrysalis and then comes out a moth or a butterfly! Since then an effort has always been made to have a "caterpillar corner" where a few common caterpillars are shown and often also grasshoppers, crickets, spiders, and sometimes frogs and toads. One may judge from the above facts what a revelation the nature exhibitions are to these unfortunate city-bound children.

It should be stated that the above data were collected in 1900, 1901 and 1902, and that at the two exhibitions that have been held since the new nature-study course has been in operation, it was evident that the year's work in that subject had done much for both children and teachers. Special efforts are made to help the latter by illustrating the grade work as far as we can by having as many of the plants and animals mentioned in the syllabus as possible; and the midwinter show was instituted to provide them with the birds' nests, wasps' nests, budding twigs and evergreens. In addition, whenever the teachers wish it—and they

are usually very glad to avail themselves of the offer—they are piloted about the exhibition when the children are not there and a running talk is given on the specimens, bringing out their special points of interest, also directing how to keep them and make the most of them in their class-rooms. At the close of the exhibition everything that can be kept is taken to the schoolrooms to do duty again in the regular nature-study work, often to serve as models for drawing and subjects for compositions. All else is distributed among the children, and usually the common flowers are received in such generous quantities that many boxes may be sent directly to the schoolrooms and given out to the children at once. Many times every child in the school has had at least one or two flowers to take home.

Our flowers and specimens come from many different people and from many places, not only in New York, New Jersey and Connecticut, but sometimes from an even greater distance. Many generous boxes come from the country estates of wealthy people who have been interested in the work, many through personal friends of the workers. The Park Commissioner has sent us generous contributions from Central Park ever since the work began, principally branches of shrubs and trees; and near-by chapters of the National Plant, Flower and Fruit Guild have frequently contributed. For a number of years various Junior Naturalist Clubs under the direction of Mr. John W. Spencer sent great boxes of flowers, often the largess of their own little gardens. A number of schools, many of them in the country, have sent to us regularly. It seems a particularly happy arrangement to have these country children send of their abundance to their less fortunate city cousins, and we feel that the work benefits both ends of the line. Sometimes individual names will come with each bunch of flowers; in this case each child receives a note of thanks from the city boy or girl who receives the flowers. The names of all the donors are kept, and the children write letters of thanks as part of their work in English. These letters are often very interesting, telling of the flowers that pleased them most, how they "never dreamed there could be so many kinds of flowers"; how they had often read about certain flowers but "had no idea they looked like that," and almost always, "what a nice smell the flowers had"—that seems to appeal to them all.

In order that zeal for the flower shows will not tend to the

destruction of any of our wild plants, those who send are requested to cut the flowers carefully, not to send roots, and when a flower is rare in any locality, not to gather it at all. Many flowers are collected in the suburbs of New York City, but in these cases the collections are made on the land that is there being constantly invaded for building purposes. No effort is made to secure the rarer wild flowers except a few, such as the arbutus and the fringed gentian that the children have learned poems about and whose acquaintance they make with delight. The most common flowers, as we have seen, are rarities to the children and we try to have these in such abundance that they will never forget them. We often have pails and pails full of cherry and apple blossoms, of lilacs and dogwood, asters, goldenrod and daisies; and basins heaped high with buttercups, violets, star of Bethlehem and clover.

In conclusion, the principals of the schools in which the exhibitions have been given all testify to the lasting impression they make on the children and to the impetus given to nature-study throughout the school. This reaches the teachers as well as the children, for in many cases these shows are a revelation to the former as well as the latter. A number of the superintendents are now interested in the work, and last year some good photographs were taken for the Public School Exhibit at St. Louis.

OBSERVATION BEE-HIVE FOR THE SCHOOLROOM

BY ANNA BOTSFORD COMSTOCK
Cornell University

The habits of social insects are most interesting from the human standpoint. We are interested in them because of the successful socialism that prevails in the bee-hive, the ant-nest and the wasp habitation; the perfect way they manage their communal affairs is to us nothing less than marvellous, especially since there is no one individual who directs the work which seems to be started, continued and finished through a consensus of public opinion. It is only of late that observation nests have been devised so that we are able to verify for ourselves the wonderful tales which the earlier naturalists have written for us concerning the lives of these small socialists.

The observation hive for the study of bees is simply constructed and can be made by any one who is at all familiar with the use of tools; it is also an excellent piece of work for the pupils in manual-training classes to construct. It consists of a small hive with panes of glass at the sides and is placed in the room

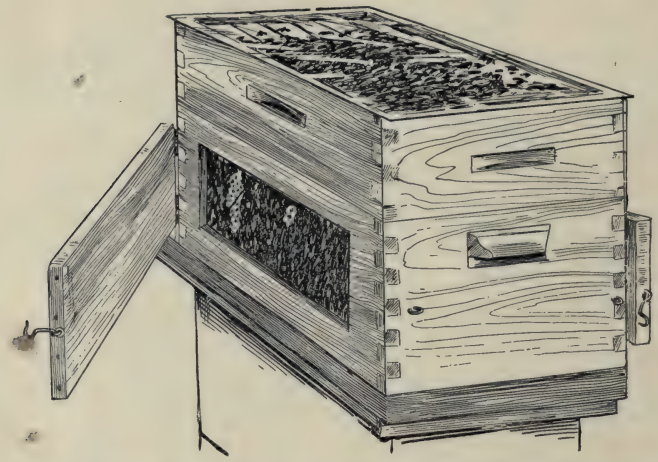

FIG. 1 — An ordinary bee-hive made into an observation hive by inserting glass panes in sides and putting a glass sheet under the wooden cover. Drawn from hive in Professor Kellogg's laboratory. (From Kellogg's "American Insects," copyright 1904, by Holt & Co.).

with the entrance arranged so that the bees may pass in and out of a raised window. We have used for this an ordinary Langstroth hive; panes of glass were inserted at the sides and on the top, over which boards were fastened when we were not observing, so that the bees would be content since they were always in the dark. We placed this hive on a table with the entrance on a window-sill; the sash was lifted an inch or so and to keep the bees from crawling back into the room a strip of wood two inches in thickness was introduced beneath the sash except in front of the entrance of the hive, thus closing the space made by lifting the window.

An excellent observation hive is one devised and used by Professor V. L. Kellogg in his laboratory at Stanford University, and which any carpenter can easily construct. It consists of a box with glass sides, large enough to hold two Langstroth frames one above the other. Thus both sides of each comb are exposed and an individual bee may be kept constantly in sight while she

is working. A passageway that leads from the entrance of the hive to the exit at the window has a glass top, so the interesting performances of the bees passing in and out while at work and the actions of the sentinels which guard the entrance may be observed. This hive has black curtains hung over it when not in use. If the glass is not kept covered most of the time so that

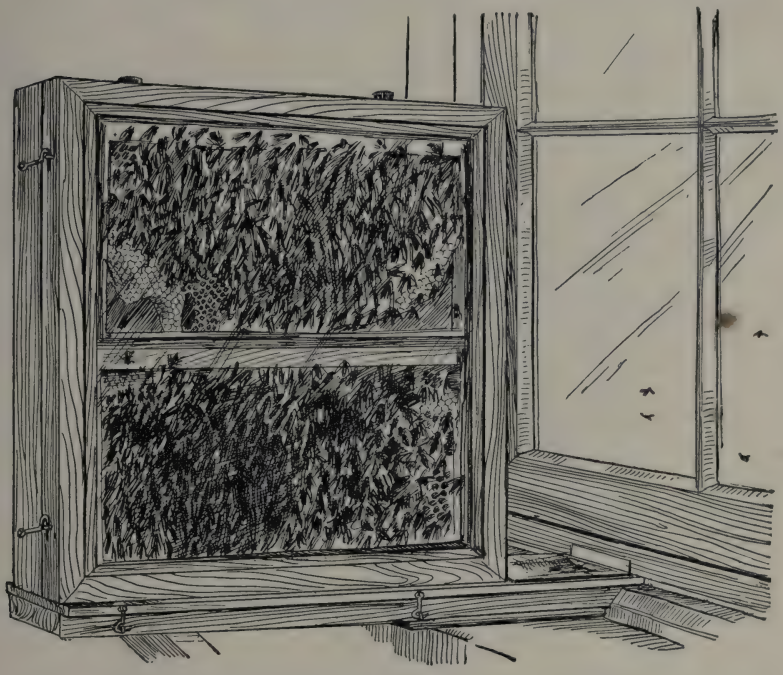

FIG. 2. — An observation hive holding only two frames, with the two sides wholly of glass, so that any single bee can be continuously watched. Drawn from hive in Professor Kellogg's laboratory. (From Kellogg's "American Insects," copyright 1904, by Holt & Co.).

the interior of the hive is dark, the bees will take the matter in charge and curtain the inside of the glass with propolis or bee-glue, thus shutting out intrusive eyes. I remember once a Sister teaching in a parochial school came to me in much perplexity; she had taken great pains to introduce an observation hive of bees into her schoolroom, and not knowing that the bees wished to have their home entirely dark, she failed to cover the glass in the slides of the hive; the bees, therefore, did it for themselves so well that after the first few days her pupils were unable to make any observations.

The A. I. Root Co., of Medina, Ohio, have a very pretty observation hive which they have put on the market at a most reasonable figure. They will ship it all set up, and if wished, filled with Italian bees and queen. This hive comes in several sizes and ranges in price from a dollar and a quarter to four dollars all stocked with bees. I would advise the size containing one frame below and a super of four sections for honey above. These sections should be ordered with starters for comb foundation in them, so that the whole process of building the comb may be observed. Dr. Edward F. Bigelow, of Stamford, Conn., has invented a very handsome and elaborate observation hive for schoolrooms; this

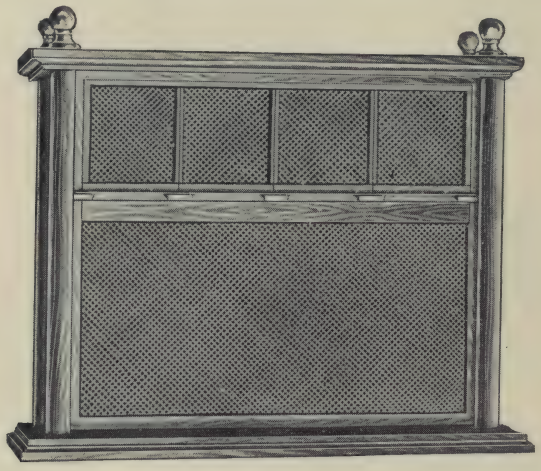

FIG. 3. — "Observatory hive," manufactured by the A. I. Root Co., Medina, Ohio.

is also manufactured by the A. I. Root Co. This hive is supplied with special division boards and a sliding magnifying glass so that the bees may be observed while feeding; they are also removable hives for temporary exhibition, and also a "flying cage" and observation hive box. I have not seen this hive as yet, but the A. I. Root Co. have sent me a description of it. It will be on the market soon, and Dr. Bigelow has refused to take out any patents, thus generously giving the public full advantage of his invention.[1]

After the hive is bought or made and is ready for use, then arises the question of how to fill it with its proper inhabitants.

[1] Dr. Bigelow will write for THE REVIEW a description of this hive and its use.—Managing Editor.

This may be accomplished by buying the bees of a regular dealer; and if the teacher has four or five dollars to devote to setting up the hive, this would be the best way to do. But if there is no money for buying bees then the nearest apiarist should be asked to donate a brood-frame filled with comb nearly covered with bees, with a queen-cell in it or provided with a laying queen already at work. If he is not generous enough to make the donation, the expense of buying this amount of bees should not be more than one dollar.

The hive should be placed in a second-story window if the school is in a village; if there is no second story, then a window should be chosen which faces away from the playground and the street, for bees do not like to have company in their front yards.

After the hive is set up and the bees are well at work the pupils will eagerly observe the citizens and the industries of the hive. The citizens are of three kinds, the workers, which do all the labor of the hive; the queen, which is the mother of all members of the colony and the drones, which are the idle sons of the queen mother. The great mass of bees on the comb are workers; in size they are smaller than either queen or drones. The queen has a long, pointed body which extends far behind her wings, and she is decidedly larger than the workers. The drone is also larger than the worker and his body ends bluntly behind his wings almost as if it had been cut off with a shears.

The industries of the hive are building of comb; the gathering and storing of honey and pollen; feeding the young; feeding and caring for the queen; keeping the house clean; stopping all crevices with bee-glue; and fanning with the wings to set up a draft through the hive, so that it will not be too warm and that the uncapped honey may ripen. All of these duties are performed by the workers. In order to make the comb they have first to secrete the wax, which they accomplish by gorging themselves with honey and remaining suspended while the wax exudes in little, white plates from wax-glands on the lower surface of the abdomen. The wax is collected and chewed to make it less brittle and then put in place. The whole process of building the geometrical cells of the comb may be observed. All of the work done by the queen is the laying of eggs. It should be noted that she is always surrounded by her devoted ladies-in-waiting, who feed her and care for her most tenderly. While the drone takes no

active part in the industry of the hive, he should not be blamed for this as he is unfitted by nature for toil. He has no wax-glands, so he cannot secrete wax; his tongue is short so he cannot gather honey from flowers; he has no pollen-baskets on his legs, so he cannot gather and make bee-bread; he has no sting, so he cannot fight the enemies of the colony. He is an aristocratic prince and his one duty is to go finally on his travels and seek some waiting princess. If he does not do this successfully and hangs around the hive after the honey season has passed, his sisters may be seen attacking him with fierce jaws and stings to put an end to his idle existence.

While studying the bees in an observation hive the pupils should also study the relation of bees to flowers, and to learn the value of these messengers which carry pollen from bloom to bloom. In order to study a flower from this standpoint, the following questions should be asked: Where is the nectar in the flower? Where in relation to the nectar glands are the pollen and the stigma? How does the bee come in contact with pollen and stigma in order to reach the nectar?

Suggestions for the Use of the Observation Hive

If possible get Italian bees for the observation hive as they are more gentle than the black bees.

Place the hive in a window above or away from the street or school-yard.

Do not keep the glass uncovered more than is absolutely necessary.

If the hive becomes too populous close it at night and take it to the nearest bee-keeper and let him take off some of the bees from the frame.

If you see the worker bees fighting, it means that robbers are attempting to get at the stores of the observation hive. The entrance to the hive should at once be contracted by placing a block of wood in front, so that there is room for only one bee at a time to pass in and out.

WINDOW GARDENS FOR THE SCHOOLROOM

BY H. D. HEMENWAY
Director of Hartford School of Horticulture

Every schoolroom should have a window garden, and can have one at very small expense. The more elaborate gardens are built outside the window and have glass sides and top, with sash that opens. These are heated during the night by leaving open the window which separates the window garden from the schoolroom proper. These window gardens can be obtained from most of the larger greenhouse construction companies at a reasonable expense, but if a school cannot have as elaborate a garden it can certainly have a very creditable one by getting an ordinary box that scythes or saws are packed in. These can be obtained from the hardware store for ten cents each. The outside appearance can be improved by covering them with a table oil-cloth, and this will also prevent the water from running out. About an inch or two at the bottom should be filled in with broken pots, brickbats, cinders or charcoal, to furnish drainage, which will lessen the danger of over-watering. The remainder of the box should be filled with a good, rich compost or garden soil. It is well to work about half a pint of bone-meal into it. The box can be filled with plants that will bloom at least part of the school year. Geraniums are among the favorite flowering plants for this purpose, because they will stand neglect perhaps better than any other plant. The dracaena (Codyline indivisa) is another plant that will stand well, and several of the flowering begonias. The presence of a single well-filled box of plants in a schoolroom will greatly improve its appearance and will help to create a love for nature in the children.

Perhaps a larger use for the window garden in the schoolroom is to start young plants for the school-garden and grounds. The process of planting seed, the miracle of germination, and the growth of the young plant are subjects altogether too infrequently taught in the schoolroom; subjects which no child can know too much about, and the knowledge and study of them will often be the means of an awakening which will not be brought about by text-book study. The window garden furnishes the beginning of the study which is to reach its height when the plants

have reached maturity, have flowered and borne fruit in the school-garden. While the deeper boxes may be used, it is perhaps better, when seeds are to be planted, to use much shallower boxes. In the absence of gardeners' flats, cigar boxes can be obtained from some near-by dealer, or some grocer or fruit dealer will gladly supply the school with fig boxes. The soil for these should be about one part rich soil and two parts of sand. The seed should be covered lightly, the very small seeds being merely pressed into

A cheap box for a window garden — a "saw-box" with begonias, dracaenas, and umbrella palm. The side of the box is covered with wandering jew (Tradescantia).

the soil with a block or board. The boxes should not be allowed to dry up; the small boxes will probably have to be watered at least twice a day. As the plants come up and grow they should be put into flower pots or tomato cans, or, if they are to be transplanted into the garden, old strawberry boxes will be better. A paper should be put in the strawberry box to make it tighter. The soil for the transplanting of seedlings should be one part soil, one part well-rotted manure and one part sand, and if the plants are to be shifted and remain in the schoolroom, upon the second shifting some fine bone-meal should be added to the soil.

Schools that can not buy plants for the schoolroom can very readily grow enough to supply the whole building at a very small expense. It will also be of more educational value to the children, although it will, of course, take more time. The following plants are named as being well adapted for successful growing, from seed, in the schoolroom:

Abutilon (flowering maple), mixed varieties; will last several years if cared for.

Little gem Alyssum (carpet of snow); blooms twelve or fourteen weeks after planting seed and if the blossoms are cut will continue blooming for six months.

Asparagus plumosus and Asparagus sprengeri; slow to start but will last for years if well cared for; do well in north windows.

Begonia semperflorens, mixed varieties; plants start slowly; bloom in three or four months after planting and continue blooming; good for both north and south windows; do best in warm rooms.

Calendula (pot marigold), mixed varieties; blooms in eight to twelve weeks after planting and continues for three or four months.

Centaurea gymnocarpa (dusty miller); white or dusty leaved plants used for their ornamental foliage; do well in north windows and will stand a low temperature.

Chrysanthemum frutescens grandiflorum and Chrysanthemum Comtesse de Chambord (white and yellow marguerites). These well-known daisy-like flowering plants will live and bloom for many months.

Coleus, mixed varieties; good for very warm and sunny rooms; handsome foliage plants.

Cyperus alternifoleus (umbrella or water palm); sow seeds in fine moss or moss and sand without covering and keep very wet; a handsome plant that is sure to do well in any window.

Dracæna, mixed varieties; slow to start, but at the end of a year they will be nice plants that will improve in appearance for several years; will stand in sun, shade, heat and cold; good sized plants will stand more neglect than any other in the list.

Fuchsia, mixed varieties; grow rapidly in warm rooms and bloom well; do well in north windows when the rooms are warm.

Kochia scaparia (standing or summer cypress); a handsome plant; completes its life in about five months.

Petunia, mixed varieties; slow in starting but a rapid grower and always covered with bloom; does well only in sunny windows.

We all admire the beautiful plants that the florists grow in their greenhouses, and no one questions but that they raise the moral standing and develop the esthetic taste, the love for nature and things beautiful. It would not be wise to try to grow some of the delicate plants that the florists have, but the above are excellent substitutes for the window garden which is the teacher's greenhouse.

A WILD-FLOWER GARDEN

BY ISABELLA G. DIGGINS
Teacher of Grade V, Upsala St. School, Worcester, Mass.

To have a garden in our school-yard seemed almost beyond possibility. The soil was sand and gravel overlaid with cinders, making a hard surface. It was necessary to procure rich loam to cover the cinders in order to provide for our plants. All the children in the building from the first grade to the seventh, willingly carried all the loam they could procure, bringing the earth in baskets and boxes, old dishes, handkerchiefs, and any old bits of paper, cloth or crockery that would hold a handful of dirt. In three days we had enough loam brought in to begin work. We chose a strip three feet wide along the east fence which was one hundred and ninety-two feet long. Then we spread the loam, with a borrowed shovel, to the depth of several inches, and after sodding the border were ready to begin planting.

We planned to have three types of wild plants: creeping vines, herbaceous plants and shrubs. The only vine procured was woodbine, but we made up for our lack of vines in our fine assortment of herbaceous flowering plants. Among shrubs we procured azalea, sheep-laurel and wild cherry. The azalea lived only long enough to blossom, because it was transplanted too late in the spring. The wild cherry is thriving yet. But of all the shrubs the sheep-laurel grew best. We procured sixty varieties of wild flowers, and they all lived and blossomed. Some of these flowers were transplanted from the woods, while others were grown from seeds. Those which were transplanted gave the best results, the most successful being the violet, white daisy, cone flower, buttercup,

false solomon seal, lady slipper, jack-in-the-pulpit, robin-runaway, mallow and celandine. The daisy and celandine were especially satisfactory. In June when school closed we left a bed of daisies about six feet long and three feet wide in full bloom.

When I was asked to take charge of this work I knew nothing whatever about gardening. However, I discovered that working and studying with my pupils was the most natural and delightful way of learning. By the close of the season we all had become

A wild-flower garden three feet wide by one hundred and ninety-two long. "It has supplied for the whole school a valuable part of its equipment for lessons in nature-study."

acquainted with our wild flowers and knew their roots and seeds and haunts as we could not have learned them from books. At seven o'clock on the bright May mornings there would often be from ten to twenty children of different ages waiting at the school-gate, of their own accord, to accompany me to the neighboring woods for flowers. The children greatly enjoyed these excursions. It was pleasing to watch the interest the children took in the garden. They protected it and studied every little plant from its budding to its seed bearing. Their admiration for the azalea when in blossom was very noticeable. They seemed aston-

ished that anything so beautiful and pink could grow in our yard.

Our wild-flower garden has proved a success from the beginning and has supplied for the whole school a valuable part of its equipment for lessons in nature-study. The gathering and sowing of seed, the hunting for plants in the woods, the planting, watering and tending—all carried out by the children under the inspiration of a common purpose—combined to yield a quality of knowledge and, more than that, a love for the flowers which no other kind of study could secure.

MAKING A SCHOOL LAWN

BY MARGARET T. BROWN

Teacher of Grade VII, Upsala St. School, Worcester, Mass.

When we first came to Upsala Street School in 1895 we found the school-grounds just as grounds are usually left at the completion of a new building. Had there been no question of economy, it would have been a simple matter to make a lawn. But having no money in our treasury and having no generous benefactors in our neighborhood, this was just the question we had to consider most earnestly. Furthermore, we wanted this lawn to be the result of children's thought and labor. With this end in view we tried by every means to awaken their interest, to make them want to beautify their surroundings.

Time was taken during the nature-study period to consider lawns. Each day the lack of one was more keenly felt as suggestions came in fast and no practical test of their efficiency could be made. The first steps—the cleaning up process, the picking up of loose refuse, the carting away of the same in borrowed wheel-barrows, and the leveling of rough places—though in itself interesting work, served to strengthen the purpose of the children and our daily tasks gained new life and interest.

Having found the soil poor in quality and scarce at that, methods of enriching it and plans for obtaining more were discussed. On applying to the Highway Department for street sweepings, we found that they could give us but little because the streets in our locality were not frequently swept. But although a little disheartened, our boys and girls showed an admirable spirit and all decided that a beginning should be made. The

ground was spaded and graded as well as could be done with the few tools at their command. The top soil was made smooth by the use of rakes. Commercial fertilizer was applied and lastly grass seed was sown. The seed used was "chaff" collected from barns in the neighborhood by our boys. It was pressed down by means of boards. As the soil and seed were poor the result was poor, but did not discourage any of us. Having made a beginning we were determined to win.

Our next attempt (in 1903) was a little more successful. Selected grass seed, added to "chaff," with an application of fertilizer, produced a thin covering of grass with many bare spots. Every blade of grass was carefully protected, the boys even coming in bare feet that they might not injure the tender plants. The whole lawn was frequently raked, well watered, and more seed scattered. Weeds could not escape so many sharp eyes. The first cuttings with the mower were allowed to remain on the ground to protect the roots from the hot sun.

From actual experience we learned many facts about making a lawn and the culture of grass. Last spring, having still a few bare spots, the children raked the whole lawn. As an experiment to decide which was the better fertilizer, phosphate was applied to the lawn on one side and nitrate of soda on the other. The lawn was well watered as often as required, and cut with the lawn mower, care being taken not to cut so close as to cause sun-burning. Weeds and coarse grass were cut at the roots or pulled up, allowing the grass to take full possession and make a thick mat. We were not able to say which fertilizer was the better, because the grass flourished on both sides. This fall (1904) we have allowed the grass to grow long so as to protect the roots from the severe winter weather.

Although the hardest work has been accomplished, our children will continue to improve the lawn by intelligent care. Having heard that wood ashes is one of the best fertilizers for our conditions, every child has volunteered to bring a small box of it next spring, and is looking forward to the time when this can be tried.

The children of Upsala Street School are justly proud of their lawn. The labor and thought expended taught them that much in the way of beautifying unsightly grounds can be done under unfavorable conditions. This knowledge has led many to attempt the work at their homes, and with gratifying results.

THE TIME REQUIRED FOR NATURE-STUDY

BY S. B. SINCLAIR, PH.D.
Vice-principal of Normal School, Ottawa, Canada

One of the most serious objections urged against the introduction of nature-study into public schools is that there is "no time for it."

Let us consider *one hour per week* the amount of time required. One of the most historic responsible pronouncements on the subject is that made in 1892 in the report made by the famous Committee of Ten, where the natural history section recommended that "No less than one hour per week, divided into at least two periods, should be devoted throughout the whole school course below the high school to the study of plants and animals; that in this study no text-books should be used, and that these observation lessons should, as far as possible, be made the basis of or correlated with work in language, drawing and literature."

Twenty years ago the writer of this article made a somewhat careful observation and study of a number of schools in the United States, England and France, in which courses in nature-study similar to those recently prescribed for Ontario schools had been for years and still are in operation.

Since that time he has had opportunity for more extended observation and experiment, and his opinion is that an average of one hour of school time per week for nature-study during the entire public school course forms a satisfactory working hypothesis. Many of the most successful teachers of nature-study give but few set lessons on the subject and vary the time and emphasis to accord with external conditions. For example, in the spring when Nature seems to awaken from her winter sleep, more time may be devoted to the subject than during the winter months. Then too it is necessary to adjust the lessons to the schoolroom conditions. For example, in a large rural school with many classes in charge of but one teacher, most of the work must be taken with combined classes or incidentally in connection with other subjects. Speaking generally, one half-hour lesson per week may profitably be devoted in every class to some definite, sequential, subject of investigation, and the other half to general unrelated observation made as occasion demands. For example,

yesterday in the Ottawa Model School a number of boys of about nine years of age, in the second grade, had a half-hour lesson on seed planting and at its conclusion undertook to make the seeds which they had planted grow. During the next three or four weeks they will have a half-hour lesson each week, devoted to a statement of the discoveries they have made regarding their plants and the difficulties they have met with, and also to a consideration of ways of overcoming these difficulties and to a fuller investigation of heat, light, soil and moisture conditions in relation to plant development. Another half-hour per week will probably be occupied in the discussion of such phenomena as the coming of the birds and the melting of the snow, and to the explanation of nature references found in the current class literature.

It may be urged that such work has always been done in schools. In reply it may be said that where such is the case the requirements of the new regulations are being carried out, and this is no doubt being done in an unostentatious and effective way in many schools. It is probable, however, that most readers have cause to remember with regret schools which they themselves attended, where more than one hour per week was wasted in memorizing abstract and meaningless definitions and records which have since been found to be incorrect, where no attention was ever paid to birds or plants, trees or flowers, the glory of the sunset or the matchless grandeur of the heavens or indeed to any of the living realities of existence outside the schoolroom, and where instead of forming habits of observation and appreciation of the objects about them, the pupils formed habits which caused them to ignore all material things as commonplace and to move through realms of profoundest mystery and intense attractiveness with blind eyes and dormant sensibilities. It is to be feared also that such schools have not yet entirely disappeared.

Nature-study reinforces other studies. It will be found that one hour per week occupied in nature-study is not really taken from other subjects if the work be properly correlated. For example, in objective drawing the first step is to gain an accurate knowledge of the object to be drawn. The time usually occupied in doing this is saved if the object has already been investigated in nature-study lessons, and experience shows that children prefer to draw such objects rather than those with no previous interest.

In conclusion it may be said that there is good reason for the

assertion that all things being equal a class which devotes an hour per week to nature-study will do better work in other subjects and make more rapid progress than if they devoted their entire time to these subjects. [From *Ottawa Naturalist,* April, 1905.]

THE METHODS OF SHERLOCK HOLMES IN NATURE-STUDY

BY E. A. GREENING LAMBORN

Sir Arthur Conan Doyle's famous detective was able from an examination of an old bowler hat to give an account of the appearance, occupation, habits, character, and worldly circumstances of its owner. Similarly, from an inspection of his friend's watch, he was enabled to discover that its former owner was a man of fallen estate and character, a drunkard, spendthrift, etc., a physical wreck, and a victim of chronic poverty. Many other instances will occur to the reader in which Holmes was able, by the exercise of his sense organs and his reasoning faculties on some concrete object, to construct a whole chain of facts with which that object was connected.

In the explanation of the methods by which he arrived at these results, it will be seen that the faculties upon which he depended for his conclusions were:—

1. *Observation,* by which he obtained the external facts connected with the object. In the case of the hat above quoted, he observed the size, shape, condition, kind of lining, newly-cut grizzled hairs, smell of lime-cream, tallow stains, etc.

2. *Deduction,* by which he gained new facts as inferences from the ones already obtained. From the large size he deduced a large brain and consequent intellectual power, from the quality of the hat the well-to-do state of its purchaser, and from its interior stains his physical condition, among other inferences.

3. *Memory,* by which he was able to associate his newly-discovered facts with those in his past experience. For example, his memory informed him that the particular shape he had observed was in fashion three years before, so fixing the time of the hat's purchase.

4. *Constructive imagination,* by which he was able to combine his facts and build them into a homogeneous hypothesis—that the person he wished to discover was Henry Baker, a man

formerly well-to-do, fallen on evil days, of sedentary habit, in poor domestic circumstances, etc. The story, of course, is that of "The Blue Carbuncle."

In his wonderful power of obtaining facts from the examination of concrete things the great detective of fiction is an ideal type of the nature-student. Though his observations of nature were limited mainly to man, and especially to criminal man, yet the faculties and the methods he employed are equally applicable to all natural objects; and if objection be made that Sherlock Holmes never existed, even without the knowledge that he is the creation of a man of science and had a prototype in fact in Dr. Bell of Edinburgh, it may be remembered that the great "nature-student" Cuvier, by the exercise of precisely the same faculties as those previously analyzed, was able, from an examination of a single bone, to reconstruct in imagination the animal of which it formed a part. This illustration in actual fact is at least as wonderful as any of the detective's logical achievements in fiction. The faculties used by Sherlock Holmes and Cuvier are simply those possessed but not used by the average child in the elementary school. This is the great attraction of *Sherlock Holmes.* When he explains his course of reasoning to his astonished clients, they realize that all that he saw they might have seen also, and that the faculties which seemed supernatural were really the ordinary ones which they shared in common with him, but which in his case were used, in theirs were neglected. It should be noted, however, as Holmes repeatedly points out in his "explanations," that people fail, not to *see* things, but to *reason* from what they see. They do not "proceed to draw inferences from their observations." For instance, millions of people before Sir Isaac Newton had *seen* an apple fall from a tree, but no one until his day had ever gone further and reasoned *why* it fell. This has an important bearing on nature-study in schools, as it proves that, somewhat contrary to the common idea, it is in deductive power rather than in observation that training is required.

To illustrate the application of the foregoing to nature-study in the elementary school, the writer proposed to describe the progress of an "investigation" which took place in his own school. By the exercise of their faculties of observation, deduction, memory, and imagination on the *foot* of a creature they

had never seen or heard of, the children were led to reconstruct a mental image of that creature, and to deduce various facts connected with its habits and surroundings. (The sceptical are invited to find the faulty link in the following chain of argument before talking of "impossibilities.")

A "newly-severed" foot was discovered by a boy on a local dust-heap, and not knowing to what manner of creature it belonged, he brought it to school to be examined. The foot was about as large as that of a small fowl, and was completely covered with thick white fur or feathers. This much was obvious from a superficial observation. Closer observation disclosed four toes beneath the covering which was seen to consist of hair-like feathers. Memory thus assisted to furnish the first deduction, that it was the foot of a bird. (*N. B.*—This, as will be seen in the sequel, was *not* immediately obvious, as the foot superficially rather resembled that of a large white rabbit.) The deduction from the size of the foot was that the bird was rather larger than a partridge but smaller than a fowl. From the color and thickness of the feathers on the foot the inference was that the bird would be warmly covered with thick, downy feathers in which white was the prevailing color. But the children's previous experience had told them that, by a recognized law of nature, the structure of any creature depends upon its surroundings. The bird in question must therefore have its home in a cold climate amid a snowy environment. It was therefore not an English bird, but probably came from the north. Geographical knowledge fixed its probable habitat as Northern Scotland, Norway, Sweden, or Russia. Further, the children knew, from a previous lesson on the stoat, that most wild creatures whose prevailing color is white change their color with the season and darken as the snow melts. The color of the bird in question might be therefore expected to vary with the seasons.

Observation of the toes showed the claws to be small and weak. The owner was evidently not a bird of prey. It was not a swift runner either. Neither could it scratch the earth in search of food. Could it, like many weak-toed birds, be insectivorous? The previous deduction of a cold climate negatived this hypothesis. It was certainly, from its feet and plumage, not a water-bird. "Eliminating the impossible," as Holmes did, it did not prey on other birds, nor get its food from beneath the ground,

nor from the air nor the water. Therefore it must live on plants which grew above the ground. But its weak, muffled foot showed that it could not perch in trees to feed on fruit or berries (the rigorous climate, again, was against the presence of trees). Such a bird looked like starving until it was suggested that it fed on leaves and shoots of plants. This again corroborated the early inference of a harsh climate, as these would be almost the only food available. (Some of the children had read about the reindeer and its food.)

Again, the clumsy foot was much against the possibility of the construction of any nest. A bird with such a foot would most likely lay its eggs on the bare ground. In accordance with a law previously quoted, the eggs would probably be of a brown tint, mottled to resemble the earth. The number of eggs would tend to be large, first because "ground-game" are especially assailable by enemies and seldom rear the full brood, and also because, however many eggs are laid on the ground, there is no danger, as in trees, of any falling out of the nest.

Summing up the facts thus deduced from the foot, the children were invited to imagine, as its owner, a bird as large as a small hen, covered with thick white feathers even to its toes, inhabiting the countries round the Arctic Sea, feeding on lichens, leaves and young shoots of plants, and laying a large number of brownish eggs on the bare ground. Obviously the next thing was to discover whether such a bird existed in fact, and if so, what it was called.

Sherlock Holmes having evolved such a description of an unknown individual, would have discovered the person answering to it by making inquiries in the locality in which he thought he might be found. As it was plainly impossible in this case to inquire in Northern Europe, a natural-history book was procured, and the plates in it were examined to see if any one of them tallied with the mental image gained by the children. Practically all the children recognized at once a plate which was stated to be a picture of the ptarmigan. The appended description was then read by one of the boys, and it was seen that practically all the deductions were correct, and that also the printed account only supplemented the deduced one in some minor particulars. This the reader may see for himself by reference to any book on birds.

It is not, of course, suggested that children could possibly arrive at such a result unguided, but it is in good faith asserted that all the deductions above stated were elicited from a class of older scholars who had never seen more of the bird in question than the foot they had before them. Such an object lesson as the one described is doubtless very uncommon, and opportunities for a similar prolonged course of reasoning would rarely occur in school work; but the writer's aim in describing it is to show the possibility of applying in school work those methods and faculties which Sherlock Holmes in fiction and Cuvier in fact used with such striking results. It seemed an exceptionally good illustration of the way in which the various faculties should coöperate and their results be coördinated in the " scientific " examination of a natural object. But in every nature-lesson examples will occur of the way in which a single observation may furnish several deductions, which may again be associated with facts already in the memory to enable the imagination to build up a hypothesis. [From *Indian Journal of Education,* Madras, January, 1905.]

ORIGINAL OBSERVATIONS FROM ELEMENTARY SCHOOLS

[EDITORIAL NOTE.—As stated in an editorial in the March issue, this department is intended to record observations made in connection with nature-study classes in elementary schools. It is not aimed to make this a place for recording facts new to professional naturalists, but rather to stimulate careful and critical observation in schools.]

An Interesting Canary's Nest. All lovers of nature are interested in the controversy going on between the " Old School Naturalist " and the " New." The one looks at the animal from the anatomical point of view and says, " Impossible "; the other, from the so-called psychological point, introducing feeling, and no doubt romances a little, and says, " Probable and possible." The observer sits quietly by and uses his eyes, placing confidence in things actually seen.

Two years ago a large cage for birds and small animals was constructed near the Training Department of the San Jose State Normal School, in such a position that the children of the various departments could, from the windows, observe the action of the

animals. All the birds—canaries, finches, cardinals, doves and paraquets—were placed together. When the nesting season came, the children of the lower grades, as was their yearly custom, wove baskets for nests, and these were placed in the bushes and trees. One canary, which was born in the Kindergarten, and spent four

A canary's nest. The string is woven around and through the nest.

years of her life there, refused the kind of nest that she had been accustomed to occupy, and constructed one of her own out of the material collected from the ground, as shown by the accompanying photograph.

John Burroughs, in a recent article, "Do Animals Think?" says, "The family of birds to which the canary belongs are not weavers; they build cup-shaped nests . . ." This nest has a distinctive weaving stitch, and the string, either accidentally or intentionally, is run around and through the nest. If the bird has "human intelligence," there is no reason why she should not have learned the "coil," as it is the first attempt at weaving taught the children. If it was accidental, then the bird certainly used the string to the best economy for the strength of the nest. If in her new environment and larger life, instinct came to the

bird's aid, she took the material at hand and fashioned a nest after her own way.

Does it not raise a question whether the ability to weave is to be confined to the class of birds called weavers? To the writer, at least, it seems evident that either instinct or "bird reason" taught her that in the absence of the strength of the usual artificial nest, something new had to be brought into service to make the nest stronger. D. R. WOOD.

STATE NORMAL SCHOOL,
SAN JOSE, CALIFORNIA.

I have seen a number of canaries' nests, but have not known of one acting in any such manner. Certainly the finches do a good deal of a rough sort of weaving, especially in lining the nest. The chipping sparrow's nest is a model in point. This instance may be explained, it seems to me, as the re-assertion of a native instinct on bringing the canary back to a more natural environment. C. F. H.

BOOK REVIEWS

A B C of Bee Culture. By A. I. Root, revised by E. R. Root. Pp. 490, illustrated. Medina, O., A. I. Root Co., 1905. $1.20.

This well-known "cyclopaedia of everything pertaining to the care of the honey-bee" first appeared in 1877, and nearly 100,000 copies have been sold. For the information of readers who have not seen earlier editions, we explain that it is arranged on the dictionary plan for ready reference in connection with practical work. If one wants at any particular time to know about hives, stings, drones, queens, swarming, wintering, enemies of bees, robbing—to take at random only a few of the interesting topics which come to mind—full information of a very practical kind is to be found under these headings. There are hundreds of good figures which add to clearness of the descriptions. Any one who has any practical dealings with bees will find this book indispensable; and many persons have found it very interesting reading quite apart from actual bee-keeping.

In this connection it may interest some readers to know that the publishers of this complete guide issue several interesting pamphlets for amateurs wihch are good introductions to the A B C volume. Among these are "Habits of the Honey-Bee" and

"Outfits for Beginners in Bee Culture," both of which are free to those interested. M. A. B.

Manual of the Trees of North America. By Charles S. Sargent. Boston, Houghton, Mifflin. 1905. Pp. 826, fig. 644. $6.00.

Professor Sargent's "Manual of the Trees of North America" is a welcome addition to any nature-study library. Giving in condensed form the substance of the author's standard "Silva of North America," this manual is of convenient size for handy reference. Trees of all regions of North America, exclusive of Mexico, are included and their identification is facilitated by reference to a regional map of the tree vegetation. The book is thus of more general use than any of the small manuals published heretofore. An analytical key to the families based on arrangement and character of the leaves, and keys to genera and species are given. The species are illustrated by Mr. Charles E. Faxon with drawings of leaf, flower and fruit. What may seem to the general reader like a disproportionate amount of space is given to the 132 species of Cratægus out of the total 630 species described, but the book is, nevertheless, by no means too technical or special and will be found useful by all persons who are interested in out-of-door things. A. WATTERSON.

Nature-Study with Common Things. By M. H. Carter. N. Y., American Book Co. 1904. Pp. 150, illustrated. 60 cents.

This "laboratory guide" for young pupils, of the fourth, fifth or sixth years, consists of questions and directions for practical class-room study of common fruits and vegetables, such as are readily obtained from the markets—blackberry, plum, pear, grape, radish, potato, apple, lemon, orange, onion, beet, carrot, pea, cranberry, strawberry and cherry. The aim of this work is simply training and developing the power of accurate observation, "learning how to learn," for its own sake without regard to the relative value of the facts learned. The author states that "many of the observations the pupil is called upon to make in these lessons bear upon no conclusion. They make no attempt to explain anything, but are for the sole purpose of being made."

Each object is to be studied in a single one-hour lesson, exclusive of drawings and written work. Concerning the latter, the author believes that "the teacher who sets too great a premium upon the language side of nature lessons create pupils *who want to see only in order to say*, and their cursory and shallow observa-

tions dribble away at the ends of their tongues without having an idea behind. The child's attention must be held to what he can *see*, not to what he can say, if he is to get a clear-cut mental image."

Concerning original observations by pupils, the author gives this sensible advice which many teachers will do well to follow: "Another thing a teacher ought scrupulously to avoid is letting the child get the notion that he is making new discoveries except for himself. This thought may stimulate him for the moment, but in the long run it is injurious to his intellectual development. To-day it is almost beyond the bounds of human possibility that a child should discover an unknown fact in the sciences, and the thought that he can do so will either engender in him an arrogant self-conceit, or it will entail a cruel awakening which may convince him that all effort on his part is useless. The ideal to hold before the young student is the desire to see and learn for himself all that others have seen and learned before, and then more if he can."

Altogether the book impresses the reviewer quite favorably. It seems certain that most schools would strengthen their nature-study as a whole by following, in the fourth or fifth grades, this guide through its seventeen lessons. Many educators are far from being convinced that any observation not directed towards obtaining useful knowledge is best; but at present this is interesting theory and not capable of rigid practice, and in much of our nature-study we can do no better than lead pupils to see observable things and trust that the practice of observing may in itself be ample justification for the work. Until some one arranges a similar book taking account of both training in observation and useful knowledge Miss Carter's book will fill an important place, especially in schools where the teachers require definite guides in their nature-study teaching. M. A. B.

Mosses with a Hand Lens. By A. J. Grout. Second edition with Hepatics. Pp. 16–208. 8vo. Illustrated. New York, The O. T. Louis Company, 59 Fifth Avenue. $1.75.

There is far too little appreciation of the mosses and liverworts as objects of natural-history study. To be sure many of these beautiful plants are much too small for the younger pupils of the elementary school, but they may at any rate be studied *en masse*, while for the older pupils the larger forms, of which there

are many, may very properly be studied in a not too detailed way, especially on field trips and by growing them under cover in the schoolroom, to which they lend themselves well. Until the appearance of Dr. Grout's earlier book of the same title no means was at hand for the guidance of those who, with little technical knowledge, desired to acquaint themselves with these lovely if lowly forms, the mosses. The second edition, which we notice here, extends the scope of the book to include the liverworts, which are on the whole less conspicuous even than the mosses, but which are as easily studied in a general way. The uninitiated have now a simple guide for the study of these which calls for the use of a simple hand lens only. The illustrations are very good. Certainly every teacher of nature-study will find Dr. Grout's book of much help. F. E. L.

Book of April and May Flowers. By Anna Botsford Comstock. New York, American Book Co. 1904. Paper, 65 pages.

The full title of half of this book is "My own book of three flowers which blossom in April," and the second half is devoted to three flowers of May. It is essentially an attempt to correlate nature-study, art and language, the book consisting of suggestions for drawing and describing the flowers on blank pages inserted for that purpose. The April flowers selected are hepatica, spring beauty, and adder's tongue; and squirrel corn, trillium and jack-in-the-pulpit are the flowers for May. An accompanying book of fourteen pages gives notes and suggestions for the teacher. Both pupil's and teacher's books appeal to the reviewer as having many points of excellence.

NOTES ON RECENT PAMPHLETS AND MAGAZINE ARTICLES

Physical Nature-Study. Recently published leaflets in the Hampton Institute series deal with "Simple Experiments in Physics" (Physical Nature-Study). Leaflet No. 17, "Water," by Sarah J. Walter, suggests experiments to show "changes due to heat and cold," under the topics evaporation and condensation. A second leaflet (n. s. Vol. I, No. 1) by the same author deals with "Heat," its sources, effects upon solids, liquids and gases. 5 cents each.

Hampton Leaflets. Other recently issued leaflets in this series are: "Sheep," "Notes on Transplanting," "Some Birds Useful to the Southern Farmer," 5 cents each.

Beneficial Soil Bacteria. Farmers' Bulletin 214 (free) of the U. S. Dept. of Agriculture is a very interesting account of the nitrogen-fixing bacteria which live in the nodules on roots of leguminous plants, such as clover and peas, and the relation of these bacteria to the fertility of soils. The recently perfected methods of artificially inoculating soils are fully described.

Bird Leaflets. Educational Leaflet No. 12 issued by the National Association of Audubon Societies deals with the short-eared owl—description, habits and economic relations. The full list of leaflets published to the end of 1904 includes: (1) night hawk; (2) mourning dove; (3) meadow lark; (4) robin; (5) flicker; (6) wild pigeon; (7) snowy heron; (8) marsh hawk; (9) red-shouldered hawk; (10) sparrow hawk; (11) screech owl; (12) short-eared owl. Information concerning the leaflets and the Audubon Societies may be obtained from Mr. William Dutcher, 525 Manhattan Ave., New York City.

Field Notes in Nature-Study. Under this title the Cincinnati Teachers' University Club of Natural History is issuing a series of pamphlets intended primarily to aid teachers of the Cincinnati schools in their nature-study work. Pamphlet No. 1, "A Chapter from the Insect World: Butterflies, and moths," is by Professor William Osborn. No. 2, issued in March, treats of "Land Sculpturing Displayed about Cincinnati"; and the editor has added some very useful suggestions which will help teachers in presenting to pupils the simple facts regarding land sculpturing. No. 3, "Land Snails," will be ready soon. The Club has arranged a system of affiliation for nature-study clubs in schools and will soon publish a pamphlet on "How to Organize and Keep Alive a Nature-Study Club." Full information may be obtained from the Department of Biology, University of Cincinnati.

"Best Books." Lord Avebury's (Sir John Lubbock) revised list of 100 books from all languages, which has been recently published, includes five books directly relating to natural history: Humboldt's "Travels," Darwin's "Voyage of the Beagle," White's "Natural History of Selborne," Cook's "Voyages," and Darwin's "Origin of Species."

Natural History of the Dog. The *Open Court* is publishing an interesting series of articles by Dr. Woods Hutchinson, on "What the dog is built to do," "an Introduction to the Rational Study of Natural History for Children." It is essentially a study of the domesticated dog from the standpoint of the adaptations of structure and habit which have a close relation to the animal's life.

Department of Agriculture Publications. The latest "Monthly List" announces the following new and reprinted bulletins and circulars which are of interest to teachers of nature-study and elementary agriculture. Those with a price attached are for sale by the Superintendent of Documents, Washington, D. C.; all others are free upon application to the Secretary of Agriculture.

A Primer of Forestry. Part II. Practical Forestry. Bulletin No. 24, Bureau of Forestry. Price 30 cents.

Cuckoos and Shrikes in their Relation to Agriculture. Bulletin No. 9, Division of Biological Survey. 5 cents.

Food of the Bobolink, Blackbirds and Grackles. Bull. 13, Div. Biol. Surv. 5 cents.

The Relation of Sparrows to Agriculture. Bull. 15, Div. Biol. Surv. 10 cents.

Birds of a Maryland Farm: A Local Study of Economic Ornithology. Bull. 17, Div. Biol. Surv. 15 cents.

The Honey Bee: A Manual of Instruction in Apiculture. Bull. 1, New Series, Division of Entomology. 15 cents.

Bird Day in the Schools. Circular No. 17, Div. Biol. Surv.

The Common Squash Bug. Circular No. 39, revised, Bureau of Entomology.

Two Vanishing Game Birds: The Woodcock and the Wood Duck. Reprint from Year-book of Department of Agriculture for 1901.

The Relation of Forests to Stream Flow. Reprint from Yearbook 1903.

The School Garden. Farmers' Bulletin No. 218.

Nature-Study for Primary Grades. This is the title of No. 16 of the Hampton Institute series, by Annie M. Goding and Mary C. Breen, of the Washington, D. C., Normal School. The outline is intended for the three lower grades, but no attempt is made at specifying the particular work for each of these grades. The plan is arranged according to the seasons, and for fall, winter and spring many interesting studies are suggested and numerous references given. The pamphlet contains 28 pages, and the price is 10 cents.

Practical Studies in Agriculture. A pamphlet of forty pages from the School of Agriculture of Purdue University, prepared by Professor M. L. Fisher, contains in Part I clear directions for twenty-seven practical studies closely connected with agriculture and in Part II are directions for fifteen "experiments for home study." The pamphlet will be very helpful to teachers who are arranging courses in elementary agriculture.

NEW BOOKS RECEIVED

In addition to books reviewed in this issue the following are reserved for future notice:

Experiments with Plants. By W. J. V. Osterhout. N. Y., Macmillan Co. 1905. Pp. 492, figs. 252. $1.25.

Nature Study: A Pupil's Text-book. By F. Overton and Mary E. Hill. N. Y., American Book Co. 1905. Pp. 142, illustrated.

Physiology and Hygiene for Children. By Robert Eadie and Andrew Eadie. N. Y., University Pub. Co. 1904. Pp. 204.

GUIDE TO PERIODICAL LITERATURE

A BIBLIOGRAPHY OF THE LEADING MAGAZINE ARTICLES OF INTEREST IN CONNECTION WITH NATURE-STUDY

SEPTEMBER, 1904, TO APRIL, 1905

ARRANGED BY ADA WATTERSON

Tutor in Biology, Teachers College, Columbia University

[EDITORIAL NOTE.—The bibliography for the first eight months of the year 1904 appeared in the January and March issues of THE REVIEW.

It has not been attempted to make a complete bibliography; but rather to select those articles which appear to be most important and accessible in most public libraries. In the case of periodicals designed for local circulation, only articles of exceptional merit will be catalogued.

The figures with black face indicate the volume and those following the : refer to the pages. The abbreviations of journal titles and dates are those used in the general indexes to be found in libraries.

Readers are requested to inform the compiler concerning any important omissions.]

1. EDUCATIONAL AND GENERAL DISCUSSIONS OF NATURE-STUDY

Bass, W. S. Science in the Francis W. Parker School. Ele. Sch. Teacher. **5**: 97–113. O. '04.

Brown, I. M. Nature-study in the third grade. N. Y. Teachers' Mono. **6**: 34–43. O. '04. (Study of birds and house-fly.)

Guyer, M. F. The question of method in nature-study. Ped. Sem. **12**: 86–92. Mr. '05.

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QUESTIONS AND ANSWERS

[This department will be devoted to the many little practical problems which are of interest to teachers of nature-study; and all readers are invited to use this column freely. Questions should be sent to the office of the managing editor. Some will be answered by members of the editorial board, while others must be referred to readers for answers in later issues. But in all cases the answers published are subject to discussion, correction, or addition by readers. We hope to have such supplementary answers within a month after the appearance of the first answer.]

Nature Study or nature-study. In reply to several questions regard the form "nature-study" which is used in this journal, except where in quotations the form "Nature Study" may occur, it should be said that it was adopted as the preferred form after consulting many authorities on similar compounds. The word nature-study is too young for the common dictionaries, but similar compounds, such as nature-worship and nature-print are in the leading dictionaries hyphenated. Aside from the authority of lexicographers, there is a special argument for the hyphenated form in that we now have reason to speak of biological and physical nature-study, and the hyphen makes it clear that the adjective modifies the combined words.

With regard to the capital letters, the old custom of writing Nature, meaning the material universe, is rapidly passing; and especially in the case of nature-study as a school subject there is no more reason why capitals should be used than in the case of arithmetic, geography, chemistry, etc.

Classification of Birds. In reply to a question referred to readers in No. 1 of this journal, it seems to be the general opinion of the best teachers that the scientific classification of ornithologists has no proper place in elementary schools. Instead it is better to group birds as scratchers, swimmers, waders, birds of prey, climbers, perchers, naming the groups according to the most obvious adaptations in external structure. This classification from the old natural history does not agree with the modern system which takes account of the comparative structure of internal organs, but for nature-study purposes the old grouping is certainly best because it is based on what pupils can actually see and understand.

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THE

NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS.

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Vol. 1, No. 4 July, 1905

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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THE NATURE-STUDY REVIEW

THE SEPTEMBER NUMBER

An important 25-page **paper on nature-study and its relation to geography in the elementary school,** with outline of course, **by Dr. Fairbanks** was set in type for the present number, but the author's absence on a geological exploring trip in the mountains of California has made it impossible to consult him regarding certain points in the proof, and the paper will be added to the September number, thus adding to the volume the sixteen pages required to make this issue **the regular 48-page magazine.**

IMPORTANT ANNOUNCEMENT

THE REVIEW in its first year has been so well supported that in January (No. 1 of Vol. 2) it **will be changed from a bi-monthly to a monthly** for the school-year (nine months). The price will remain **$1.00 per year.** This change will make the magazine more valuable to teachers actually dealing with nature-study in schools, because it will be possible to give much more attention to answers to questions, timely topics, suggestions for the month's work, etc. As previously announced, THE REVIEW is the result of the cooperation of many workers, and all income exceeding cost of publication, including necessary business expenses, will be used for improvements. Having gained monthly publication, it will be the aim to increase greatly the number of pages and illustrations.

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THE

NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

VOL. I JULY, 1905 No. 4

NATURE-STUDY VERSUS AGRICULTURE

BY W. M. HAYS

Assistant Secretary, United States Department of Agriculture

In preparing pupils for the study of science and industry, three main objects are to be attained: the pupil must be thoroughly and permanently interested; he must be led into the scientific method of approach; and, finally, he must be given the facts and trained in the practices incident to the profession or the industry.

The logical manner of taking up these objects might seem to be with method proceeding from the first to the last; but the individuality of the pupil is the most important thing to recognize and to develop. The methods and the acquisition of a body of thought and of skill in doing things must center in the individual, and liberty to use the means without too strict adherence to sequence must be accorded, that advantage may be taken of interest and of means as they present themselves.

It may be wisest, as a general method of handling classes, to place nature-study during the first several years of the school, but this should not preclude the use of every available industrial fact and method of work which can be made to contribute. The country boy or girl, for instance, is constantly concerned with that which interests and that which develops the ability to understand and work in the farm and home industries about him. The chores in the morning and evening hours, the vacation duties on Saturday and during longer vacation periods should be utilized by the cooperative direction of teacher and parent. Every passing thing of interest should be seized upon to arouse and instruct the pupils of all grades. There are many things in the rural

school which require that the whole school be a single class. That which is most lacking is often the scientific method of thought, and this really should be the first function of nature-study teaching. The pupil should be taught to follow from effect to cause and from cause to effect; to classify objects; to correlate activities and ideas; to observe in detail, and also to view the general relation of things. As the personality of the teacher is the most important element in the schoolroom, so the development of individuality in the pupil is the most important element of schoolwork. The objects, the activities, and the personal contact with the teacher which comes from nature-study, often prevent the narrowing effect in methods of thought of mere book teaching and avoids suppressing individual initiative. Nature-study may not result in such apparent accumulation of facts as mere book work does; its greatest function is to prepare the pupil to acquire facts in after life as they are needed.

Agriculture in city schools should hardly be regarded as an industrial subject. It is there rather a culture subject. City pupils should know something general and in detail of the agriculture of their country, that they may better know of their country. There is no part of history so important as present history; and no man can claim to be educated who has not a broad knowledge of what the people of his own country are doing. The body of thought of farm and country life being put into pedagogical form makes an excellent culture study for city high schools. Since economic conditions carry people from the country to the cities, with but a slight movement in the opposite direction, there is not much of an object in teaching agriculture in city high schools with the hope of thus inducing people to become farmers; but this line of instruction can greatly aid in inducing a larger percentage of city folk to move on to suburban acre properties.

The country boy or girl who has had, prior to the seventh grade, considerable nature-study taught in the proper way is better prepared to take up instruction in agriculture and home economics. The body of thought being accumulated by agricultural experiment stations and other institutions of research is being put into splendid form for industrial teaching. Texts, laboratory methods, plans of actual practice work, are being rapidly devised for use in schools and all classes. Achievements already made along these lines lead to the hope that ere long we shall

have splendid texts for small rural schools, for consolidated rural schools, for agricultural schools, and for agricultural colleges. There seems no reason why the consolidated rural school in a district five miles square, the agricultural high school accommodating one county, or, better, several counties, and the agricultural college in each state, should not be articulated into a system for country life parallel to the system of city graded schools, city high schools and universities, which are already unified in the work of educating for city life. Nature-study in the rural school and in the city graded school will prepare the minds of all pupils for scientific and industrial subjects. Because so many drop out before the high school, there is every excuse for making this nature-study somewhat industrial in its nature. The farms, city industries and the homes everywhere will receive benefit from nature-study properly taught, and some practical subject-matters relating to these industries can be worked into nature-study teaching quite as well as subject-matter not industrial in character.

Systems of text-books and of laboratory practice will no doubt so classify instruction as to push the industrial work farther up in the course of study, but the resourceful teacher can use much out of the daily home experiences of the pupils to reinforce the course of study in the prescribed outline.

NATURE-STUDY AND AGRICULTURE

BY ANNA BOTSFORD COMSTOCK

Lecturer in Nature-Study, Cornell University

The Cornell University nature-study movement is primarily an agricultural movement. It has had for its object from the first the presentation to the child of the more interesting phases of life on the farm, and the giving him some inkling of the ways of the plants and animals that creep up unnoticed to his very doorstone, with the hope that the interest thus aroused would later deter his feet from following the broad path that leads from the farm to the city. Some there be who have criticized the Cornell method and have said, "Why not teach agriculture pure and simple from the first?" To this query one might retort with quite as much reason, "Why not teach the child grammar before it learns to speak so that its first words may be lisped according

to the rules and science of the language?" Nature-study is the alphabet and the words of one syllable of agriculture, and that is why the child should begin with nature-study instead of agriculture.

Another argument has been presented, "Why not make your nature-study along the lines of agriculture solely; for instance, why should not a child begin nature-study with the cabbage rather than the hepatica." This argument carried out logically would provide recreation for the boy in hoeing corn rather than in playing ball. Many parents in the past have argued thus, and have in consequence driven thousands of splendid boys from the country to the city with a loathing in their souls for the drudgery which seemed to be all there was of farm life. The reason the wild flowers have been selected to begin the nature-study of plants is because every child loves these woodland posies naturally, and his happiest hours are those spent gathering them. The very first principle of modern teaching demands that the child's intelligence shall be cultivated along the line of the child's interest. The child loves the hepatica, the jack-in-the-pulpit and the trillium, and is eager to know more about them; and since the fundamental truths of plant life are quite as true in the case of the wild wood flower as in that of the carrot or the cucumber, why not let the child grow in his knowledge of plant life along his natural path instead of forcing him to knowledge along a channel obstructed by his indifference or dislike. Never yet have we known of a case where a child having gained his knowledge of the way a plant lives through studying the plants he loves, has failed to be interested and surprised and delighted to find that the wonderful things he discovered about his wild flower, may be true of the meanest vegetable in the garden, or the purslane which fights with them for ground to stand upon.

For a like cogent reason gardening is begun with flowers instead of vegetables because the young child is more interested in flowers than in anything else that grows. But after the garden work is well begun and the principles of plant-growing are better understood, the interest widens to the vegetable garden naturally. Thus in every phase nature-study at its best begins at the point where the pupil's interest touches the outside world, and from this point widens naturally until it includes his whole environment.

Both nature-study and agriculture are based upon the study of life and the physical conditions, like soil, water, air, etc., which encourage or limit life. If we see clearly the relation of nature-study to science we may perhaps better understand the relation of nature-study to agriculture, which is based upon the sciences. Nature-study leads to a knowledge of the sciences of botany, zoology and geology as illustrated in the door-yard, the corn field, or the woods back of the house. Some people have had an idea that to know these sciences one must go to college, and do not understand that nature has furnished them with material and laboratories on every side and close at hand. So by beginning with the child in nature-study we make for him a laboratory in the wood, the garden or along the roadside or in the field, and his laboratory materials are the wild flowers, or the weeds of the garden, or the insects that visit the golden-rod, or the bird that sings in the maple tree, or the woodchuck that sits up and whistles in the pasture. The child begins to study living things anywhere and his progress is always along the various tracks laid down by the laws of life, along which his work as an agriculturist must always make progress if he is to make it an intelligent and successful work. The child through nature-study learns the way the plant grows whether it be an oak, or a turnip, or a pigweed; he learns how the root of each is adapted to the needs of the plant; and how the leaves place themselves to get the sunshine, and why they need it; and how the flowers get their pollen carried by the bee or wind; and how the seeds are finally scattered and planted. Or he learns about the life of a bird whether it be a chicken, an owl, or a bobolink; he knows how each bird gets its food and what its food consists of; where it lives and where it nests, and its relations to other living things. Or he studies the bumble bee, and discovers its great mission of pollen carrying for many flowers, and in the end would no sooner strike it dead than he would voluntarily destroy his clover patch. While learning all these things we call it nature-study, and not science or agriculture. But the country child can never learn anything in nature-study that has not something to do with science, and that has not its own practical lesson for him when he shall become a farmer.

Some have said to us, "We, as farmers, care only to know what concerns our pocketbooks; we wish only to study those

things which we must, as farmers, cultivate or destroy. We do not care for the butterfly, but we wish to know about the plum-weevil; we do not care for the trillium, but we do care for the onion; we do not care for the meadow-lark, but we do care for the gosling." To say nothing of the sordidness of this view, it is a physical or mental impossibility for any one to discriminate between two things when he sees only one. In order to understand the important and economic relations to the world of one plant or animal, it is absolutely necessary to have a wide knowledge of other plants and animals. One might as well say to begin with, "I will look at the approaching cyclone, but never see the sky; I will look at the clover but never see the dandelion; I will look for the sheriff when he comes over the hill, but will not see any other team on the road."

So in nature-study we strive to keep the child's eyes open to all things so that when he becomes a farmer he may be able to see all things and discriminate wisely. To one thus trained the farm is the most interesting place in the world, and the farmer has the best opportunity for continuing his education in connection with his work of any man in any vocation. All of the scientists of the world have spent their lives solving problems which nature presents; and as agriculture is based upon the sciences, and as nature is the impartial teacher, so she ever presents problems to the farmer, and well is it for him when he is able to solve them successfully. Such an one feels that on the farm is a life work that demands all his intelligence, and the widest knowledge, and in exercising these he finds supreme satisfaction.

Nature-study is the effort to make the individual use his senses instead of losing them; to learn to keep the eyes open to all things whether it be the thunder-head piled up in the western sky or the flash of oriole gold from the elm; to keep the ears open to the voices that call, whether it be the song of the cricket in the path, or the song of the hen on the sunny side of the barn. Eyes open, ears open and heart open are all that nature, the teacher, requires of her pupils, and in return she will reveal to them the marvels of life, the riches of the world, and the beauty of the universe.

Nor is the appreciation of beauty in nature's realm the least valuable factor in nature-study. While dollars and cents are necessary to success and must be looked after, yet the man or woman who looks for them alone is narrow and sordid, and lives

in a prison of thick walls of selfishness, and looks out on the world through a window darkened by the bars of avarice. The man who goes into the field in the morning with the consciousness of the sunshine, and the song of birds, and the growing green of the forests and meadows; he who understands and is a good comrade of the cunning old crow grubbing in the corn field, or the meadow lark singing in the meadow; the man who is conscious of all the life and beauty about him will do his work better, and know better how to protect his crops, and he will have a richer harvest than the one who sees the dollar mark on every leaf, and hears the chink of coin in every sound.

Some years ago we received here a letter from a Canadian farmer boy, and in this letter he says, "I have read your leaflet entitled, 'The Soil, What It Is,' and as I trudged up and down the furrows every stone, every lump of earth, every sandy knoll, every sod hollow had for me a new interest. The day passed, the work was done, and I at least had had a rich experience." Who would doubt that such a man having such thoughts would plow a straighter furrow that he who sees only the earth he turns and the horses which he perchance swears at as he goes on his dull routine blinder than the mole whose wonderful galleried house his plow disturbs.

The ideal farmer is not the man who by chance and hazard succeeds; but he is the man who loves his farm and all that surrounds it because he is awake to the beauty as well as to the wonders which are there; he is the man who understands as far as may be the great forces of nature which are at work around him, and, therefore, he is able to make them work for him. For what is agriculture save a diversion of natural forces for the benefit of man? The farmer who knows these forces only when restricted to his paltry crops and has no idea of their larger application, is no more efficient as a farmer than would be an engineer who knew nothing of his engine except how to start and stop it. In order to appreciate truly his farm the farmer must needs begin as a child with nature-study; in order to be successful and make the farm pay he must needs continue in nature-study; and to make his declining years happy and content and full of wide sympathies and profitable thought he must needs conclude with nature-study; for nature-study is the alphabet of agriculture, and no word in that great vocation may be spelled without it. [From *The Cornell Countryman.*]

NATURE-STUDY AND AGRICULTURE

BY F. L. STEVENS

Professor of Botany, North Carolina College of Agriculture and Mechanic Arts

Agriculture, dealing with plants and animals, is of all the arts most often confounded with nature-study. When agriculture is abstracted to teachable principles it becomes a science, and the science of agriculture may be differentiated from nature-study by the criteria cited in the first number of this journal. The art of agriculture furnishes numerous and valuable illustrations for nature-study work, but as an art it cannot be nature-study. The art of agriculture and nature-study may overlap so that part of nature-study may rest entirely upon agriculture. Indeed agriculture is so vast that enough subject-matter may be drawn from it to constitute an entire course of nature-study. Then this course would be agricultural nature-study. It would be the method of nature-study applied to the teaching of agriculture, but that would not make nature-study and agriculture identical any more than a selection of the subject-matter for nature-study solely from the field of mineralogy would make mining and nature-study identical. Nature-study is broad, inclusive, comprehensive. It is an invaluable aid in the teaching of agriculture. It opens the way to agriculture in the schools by awakening interest and quickening observation, and creating a love for all out-doors, but it is not agriculture.

NATURE-STUDY IN THE SCHOOLS OF NOVA SCOTIA

BY A. H. MACKAY, LL.D.

Superintendent of Education for Nova Scotia

[EDITORIAL NOTE.—The article in No. 1 of this journal on "Nature-Study and Agriculture in Canada" indicated great interest in nature-study lines at the present time. But the new movement centered at Macdonald Institute is not the beginning of nature-study in Canada, as the following historical account shows. It is certainly interesting to learn that eighteen years ago a Canadian journal was started with the object of giving special attention to the work which we now call nature-study. The publication of this paper, written several months ago, has been delayed; and meanwhile essentially the same paper has been published in the *Ottawa Naturalist.*

However, it still deserves a place in this journal, where it will be read by many, especially in the United States, who do not see the *Naturalist.*]

A systematic course of oral and objective study was outlined in the first conspectus of a course for the schools of the province, which was presented to the Provincial Educational Association at Truro on the 14th day of July, 1880, by the Principal at that time of the public schools and the Historical Academy of Pictou. This was done on the invitation of Dr. David Allison, then Superintendent of Education for the province. After due discussion the conspectus was referred to a committee for amplification and presentation at the convention held next year, where it was further discussed and passed practically in the form in which it was soon after prescribed by the Council of Public Instruction for the first eight grades of the public school system, known as the common school grades.

In 1887 *The Educational Review,* which has ever since been continuously published at Saint John, N. B., was started with the object of developing the nature-study side of the course, as well as serving incidentally as a teachers' organ for the Atlantic Provinces of Canada. Illustrated lessons on natural objects were prepared, the most continuous being the series under the title "Ferndale School." The whole environment of common-school life was more or less covered, instruction for teachers on various subjects including even the evening sky which was illustrated by a series of star maps. The Ferndale series dealt with the biological side mainly; but other papers covered mineralogy, physical phenomena of common range, and so forth, before any similar effort appears to have been made in any other province of Canada.

A little later, 1901, a science building was erected in connection with the Provincial Normal School, and the Provincial School of Agriculture, founded by the Government a few years earlier, was then more completed affiliated with it. An extra course of two years in the sciences underlying the art of agriculture was given to teachers who could take this extra time, for which a special diploma and scholarship were awarded, and an additional provincial grant of $100 given when engaged in teaching in an efficient rural school. This idea was carried out in a fuller manner by Dr. Jas. W. Robertson, director of the Sir William C. Macdonald Rural School Fund, when $175,000 was appropriated to build the

Macdonald Institute at Guelph in Ontario, and to provide additional funds for nature-study teachers and school-garden demonstrations [see this journal, No. 1, pp. 20–22].

For about twenty-four years the nature-study idea has been in the public course of study, developing gradually from morphological to biological observation—from the observation of forms to the observation of action. For a number of years records have been made in the public schools of the biological and meteorological facts capable of being accurately observed by pupils and verified by teachers, such as the dates of first flowering, leafing and fruiting of plants; the migration of birds; thunderstorms, frosts, high and low water, etc. These have proved so valuable as scientific records that for some years they have been annually compiled into averages for the different regions of the province as well as for the whole province. The schedules have to some extent been utilized in the other provinces of Canada, and a similar system has been introduced in imitation of it into some of the schools of Denmark. The main object of the scheme originally was to give some objective work to the pupils on their way to and from school, to be reported to the teacher in school. These schedules are being carefully bound up into annual volumes, for the benefit of future students of climatic and ecological conditions of the province.

In the provincial course of study special directions are given for each of the eight grades of the common schools. The general directions published in each school register gives in brief form the general character of the special directions published annually in the *Journal of Education,* which is the official bulletin of the Education Department sent free twice a year, in April and October, to each school-board in the province. These general directions, which indicate the view taken by the Nova Scotian Education Department of the character and importance of this elementary work in the public schools, are as follows:

Official Directions for Nature-Study in Nova Scotia

"*Nature Study*—The noting, examination and study of the common and more important natural objects and laws of nature as they are exemplified within the range of the school section or of the pupils' observation. Under this head pupils should not be required to memorize notes or facts which they have not, at least

to some extent, actually observed or verified for themselves. Many books on the list recommended for school libraries (see October *Journal of Ed.*, 1903) are useful guides to the teacher for portions of the work prescribed in some of the grades. There should be a short "Nature Lesson" given every day on the daily collections and observations of the pupils themselves—not on the statements of teachers or books—the lesson always being based on the objects or observations. These guide books are to be used only to show the teacher how to give such lessons. They are entirely prohibited as text-books for either pupil or teacher, for under no circumstances should "notes" from the books be given to pupils. All such studies must be from the objects. Observations under this head form some of the best subjects for English composition or drawing exercises in all grades.

"In schools with pupils of several grades under one teacher (as in most rural schools) many of these lessons may profitably engage the whole school. In nearly all, either the whole senior or whole junior divisions of the school can take part. A skilful teacher can thus give profitable object lessons to several grades of scholars at once; at one time giving a Grade V lesson, at another time a Grade VI or Grade VII or Grade VIII lesson, which will also contain enough for the observation and interest of Grade I, Grade II, Grade III, and Grade IV pupils. An object lesson given to the highest class can thus to a certain extent be made a good lesson for all the lower classes. The older pupils will see more and think more.

"It must be remembered that the memorizing of notes and facts merely stated to pupils is strictly forbidden under this head. Such memorizing is pure cram, injurious instead of being useful. The teacher may not have time to take up in class every object indicated in the Nature Lessons of the course. In such cases the pupils should be given two or three objects nearly related to the typical specimen examined in school with directions to search for and examine them at home as illustrated in the specimen class lesson. Without much expenditure of time the teacher can note that this work has been honestly attempted to be done by each pupil. The lessons must be direct from nature itself, but under the guidance of the teacher who can save time in bringing the pupils to the point desired by his more mature experience. They are intended to train the observing and inductive faculties, to

show the true way of discovering something of the nature of the world which immediately surrounds us and which is and will continue to be reacting upon us in one manner or another. This knowledge is so much power over nature, from which we have to win our material existence. It is also essential as an element in any true and useful system of philosophy.

"More stress has been laid here on the natural history of each section than on elementary physics and chemistry. Not because physical phenomena are less important, but because the elements of these sciences are the same all the world over, and there is no end to the cheap and well illustrated guides to practical work in them which will well suit a section in Nova Scotia as well as one in England or in the United States. But there are no such simple guides to the biology of each section, and many of its other scientific characters. The teacher must become a student and master them himself; for such exercises have special power in developing the habit of accurate observation (which is the soundest basis for any career ranging from that of the poet and professional man to the tiller and lord of the soil, the tradesman, the manufacturer, the inventor) and in developing in connection with history and civics an intelligent attachment to both the material and ideal features of our country."

TEACHING FACTS IN NATURE-STUDY

Notes from a paper by J. Dearness, of the Normal School, London, Ontario

A pamphlet on bees recently circulated among nature-study teachers in Canada has been criticised because of a number of inaccurate statements. This has led to the question, "Suppose it is wrong, what harm will it do?" Professor Dearness comments as follows (in *Farmers' Advocate,* Jan., '05):

"I should say that in those schools where nature-study is supposed to be information about bees and other natural objects, to be learned by the pupil as so much history, the part that is wrong will do very little harm, and the part that is right will do very little good. In ten years, unless learned again in real life, most of it will be forgotten, and the rest will be too vague for practical use.

"Take, for example, what is called 'a very wild statement,' that when the honey reaches the hive ninety per cent. of it is water.

Think of a lot of public-school children at their nature-study lesson —a lesson that is supposed to train their powers to observe and to reason about what they observe. What good or what harm will come from their learning, as book statements, that the bee 'laps up the nectar,' and carries a 'load twice its own weight,' nine-tenths of which is water. If these are facts, but facts which cannot be learned by the children's own investigation, then they are not suited to the nature-study lesson. If they can be discovered in a reasonable time by self-active investigation, then the training thus derived vastly outweighs the facts reached. Had the "Story of the Bees" shown the teacher and pupils how to discover these facts with the means at hand in a public school, it might have legitimately been labelled 'nature-study.' The proper point of view is the effect that the lesson has, not in diminishing the mountain of scientific knowledge lying outside of the child's memory, but the effect it has upon the development of the child's power to observe, to reason about what he observes, and to sympathize with the sentient world around him.

"The hive-bee may be made a capital nature-study lesson in a school where an observatory hive, suited to receive one Langstroth frame, is set against a slightly-opened window, guarded at the side so that a bee cannot escape into the schoolroom. Such a hive may be made or bought ready-made from some dealer. Instead of a story of the bees, even the most faultless one, what the nature-study teacher needs is explicit direction how to make or where to obtain such a hive, how to set it up and ventilate it, how to manage the light, etc., and a series of questions that will guide himself first, and then his pupils in their observations, the answers to be sought, not from a book, but from the bees themselves. The bees will tell no fictions.

"As a nature-study teacher, of nothing else do I feel more certain than that the harmonious development of the child in heart, as well as head and hand, either for the future farmer or town-dweller, is vastly more important than all the collections and knowledge of weeds and insects that he can possibly get at the public school. In other words, that the *how* these facts of nature are learned is far more important than the *what*. If my position is wrong, I hope some one will show the reason why."

NATURE-STUDY AND ITS RELATION TO ENGLISH

BY WM. M. HEINEY

Superintendent of Schools, Raton, New Mexico

In the multiplicity of books, charts and devices for instruction in nature, we are losing sight of nature-study, and are diverting the time and purpose, so intended, to reading and talking about nature-study, thus defeating the end which it, above all else, was intended to subserve.

Nature-study came to us as the maid of honor, or at least the devoted companion, of the laboratory method, which has so entrenched itself in the sciences of the secondary schools and colleges. And while the latter has taken extreme ground, nature-study has become perfunctory, or worse, it has encased itself in a shower of devices and books. The teacher goes before her classes with these, and reads or talks to them about the subject, always with much joy to them, and sometimes with more or less interest to herself; in scarcely an exceptional case, though, does she grasp the very value it was, and is, intended to bestow. This failure is not the fault of the teacher, but the error of those who have felt called to write and publish books on this subject of growing popularity.

Well, to the remedy: Wash off the slate and begin over. Put aside your devices, your nature-story books, and adopt the laboratory method and the field practice.

If you can control your pupils when out of the room, take them to the school-yard, the mountain side or the forests, and there see and study nature as she is. But do not look for good results from your pupils romping among or running over nature. Romping and running are of inestimable value to children, but cannot fill the place of teaching. The youthful, growing and grasping mind must be first directed to the little points of interest, and therefore, after the turbulent vitality has somewhat subsided, after a season of romping and play, call attention to the characteristics of trees, weeds, rocks, animals, birds and insects. Not all at one time, nor at one outing. One specimen may be quite enough for each child on a single excursion, and better, as a rule, if all study the same specimen at the same time.

This, however, is merely suggestive. You will probably get

better results if you transform your schoolroom, for the time being, into a laboratory.

Bring in, if possible, enough individuals of any one specimen to supply each member of the class with an object for examination. For example, let us take a cottonwood leaf. What is its shape: What the condition of its surfaces—upper and lower? What the character of its margin? Examine its veining. Lead the child to discover these characteristics and others, and report them to you. Next day examine a maple leaf in the same way. If in two sittings you exhaust the study of the two specimens, bring both for the third day, or when you have finished study of each, with the two specimens before you and your pupils, have them study likenesses and differences. Have members of the class point out features in common, and points of difference. This practice of comparing and contrasting, I believe to be of more value to the development of the child mind than the first study of the specimens. In fact, the former is but the preparation for the latter. By it he learns to distinguish and discriminate, and from it he must draw conclusions. Most of you, no doubt, have met people who have seen or have found petrified potatoes, petrified corn-cobs, etc., which, when investigated scientifically, had no resemblance whatever to the potato or corn-cob, except in contour. What was the trouble with the finder's observation? He—and he is the nine hundred and ninety-nine out of one thousand—has never had his powers of discrimination developed. The man or the woman who is without this power of discriminating, either from the want of the faculty, or the lack of its development, is incapable of rendering a judgment; and conversely, the more highly it has been developed, the sounder are the judgments rendered.

These studies, investigations and mental excursions for knowledge, to be of the greatest value to the child, must employ all the human organs of knowledge-getting—seeing, hearing, feeling, tasting, smelling. In fact, nature-study easily affords all necessary sense training.

It were belittling nature-study, however, to abandon her when one has beheld her beauty, observed her parts, torn the object of observation—perchance of admiration—asunder, named and fixed the relation of organs, or even determined the occasion of their existence, function or destiny. As an educational scheme, no

greater element has yet been named in this paper than that of giving expression to the knowledge attained, or the conclusion drawn.

The teaching of English composition is the bug-bear of the pedagogue. Make the failure of nature-study as appalling as you may, and it still stands only a close second to the failure in elementary and intermediate English.

The remedy that I have to offer is to begin, pursue and finish the drill in composition, by telling orally or in writing, the observations we have made for ourselves, instead of reproducing what we have read or have been told. Let us use our five or six senses for the acquirement of knowledge (as I have indicated for nature-study), and after it has been acquired, communicate it to others. As we advance in the grades, pupils should be led to draw conclusions and form judgments from knowledge acquired through observation of nature, these conclusions and judgments to be formulated into compositions.

The nature-study, the field work, the laboratory, the experiences of life, the rubbing against men and things, should be made the source of knowledge and the source of data from which ideas are drawn. I do not mean to say that reading as a source of knowledge should be tabooed, but it should be left largely until the child has acquired the habit of informing himself through his God-given organs for that purpose—the sense organs.

I am deeply under the conviction that until we revise our methods of composition, instruction and training, we shall continue to dwarf the intellectuality of the generations, and I believe that the procedure which I have herein endeavored briefly to outline, if followed, will add no small increment to the intellectual capacity of the manhood and womanhood of the future. [From *Colorado School Journal.*]

THE SILK-WORM FOR NATURE-STUDY

BY ALVIN DAVISON, Ph.D.

Professor of Biology in Lafayette College

The interesting and valuable results furnished by the use of silk-worms in nature-study work encourages me to report some of the information gained for the benefit of those interested in this

phase of education. The slight cost and trouble involved in securing and caring for an abundance of material make it available for schools of all classes. Eggs may be purchased at the rate of twenty-five cents per hundred of T. Keleher, 662 Massachusetts Avenue, N. E., Washington, D. C.; Dr. W. H. Hill, Peoria, Ill.; and Mrs. Carrie Williams, 1245 Logan Avenue, San Diego, Cal. Two hundred eggs are sufficient for twenty pupils. As the worms feed only on the leaves of the red, white and black mulberry trees and the osage orange, two or three of these trees should be planted on the school-ground if none occurs in the locality. The white mulberry is most desirable.

The eggs should be secured a fortnight or more before the mulberry leaves appear and stored in a moth-proof box or glass jar in a cool dry cellar or other room where the temperature is not above sixty degrees Fahrenheit. When the first minute leaves appear on the food trees, the eggs placed in a box about a foot square must be kept under daily observation in the schoolroom or living room where the temperature is from sixty-five to seventy-five degrees. As soon as the hairy black larvae, less than a quarter-inch long, break from the eggs, a dozen tender leaves smaller than the human finger-nail should be given them five times daily at intervals of about three hours. If small leaves are not obtainable, larger ones may be cut into strips less than one-eighth inch wide. Leaves with dew or water on them ought not to be used. The rate at which the worms grow depends upon the temperature and the number of times they are fed daily. Those furnished leaves only twice daily and kept cool will not reach full size in less than forty days, while a warm room and five or six daily feeds will mature the worms in from three to four weeks. They may be fed to advantage as early as six o'clock in the morning and as late as ten o'clock at night.

When a week or ten days old, ten worms should be given to each pupil providing a box four or five inches square. Covers need not be used, as the worms make no attempt to escape. During the first few days they merely suck the juices from the leaves, but later bite off and swallow particles of leaf-tissue. When they are two weeks old, full-sized leaves uncut may be fed, and these can be gathered once daily and kept fresh by placing in a bucket covered with a wet cloth.

Some of the features to be observed in the growing worms are

the molting process, manner of taking food and amount consumed and the external appearance at different ages. During the fourth week the amount of food taken may be quite accurately reckoned by cutting the leaves into pieces an inch square and keeping a record of the number of squares eaten. Other data furnished by the United States Department of Agriculture will enable the pupils to work out the number of leaves required to make a silk dress. Two dozen worms will consume about one pound of leaves during the five days succeeding the last molt. Interesting results may be obtained by rearing some worms in a cool room and with a limited amount of food. Care should be exercised that accurate records of observations are made by the pupils daily.

Eight or nine days after the last molt, when the larvae become restless and wander about the box, two or three small bushy twigs should be supplied to afford fastenings for the cocoons, as those spun along the sides of the box are sometimes imperfect. In from fifteen to twenty days after the formation of the cocoon, the adult moth comes forth if the temperature has been about seventy degrees. Cold lengthens the period greatly. One cocoon should be cut open the third day after the spinning was begun; another, on the fifth; and another, on the thirteenth day, so that the changes in the inmate may be studied. These individuals, even when removed from the cocoons, will in some cases give rise to moths.

Within a few hours after the moths emerge, the female will begin to deposit its batch of five or six hundred eggs, which of course will not be fertile unless union with a male has occurred previously. It is therefore important that a male moth, easily recognized by its smaller abdomen, should be placed near a female within a few hours after breaking from the cocoon if the eggs are to be used the following year. Fertile eggs will become grayish a few days after being laid, while others remain white. The moths take no food and die within a week or two after birth, but the eggs may be preserved for hatching the following spring by keeping them in a vermin-proof box placed in a cool dry cellar or other room having a temperature not above sixty degrees and not below the freezing point. A temperature as high as seventy degrees before Christmas will do no harm.

A few days before the moth issues the fiber forming the cocoon may be uncoiled on a spool or pencil by removing the loose outer

silk and soaking the cocoon a few minutes in hot water, permitting the thread to be loosened with a pin.

Any one expecting to rear the silk insect should request the United States Department of Agriculture, Washington, D. C., to send him Farmers' Bulletin No. 165, by H. A. Kelly. It is free.

The value of the silk-worm for nature-study work cannot be overestimated. The pupils may be taught so effectively the important lesson of how life responds to the patience and care bestowed upon it. They may witness the transformation of vegetable material into animal tissue and be brought into intimate association with the indirect process by which mother earth is transmuted into the most beautiful of fabrics. A contact point is secured for giving a lesson teaching the miserable condition of the lower classes in Italy, China and Japan where silk-worm raising can be carried on commercially because of the starvation wages accepted by the peasants. The interesting history of the origin and spread of the silk industry may give the child a yearning to know more of oriental life. The four stages in the development of the insect are the same as those occurring in about half the species of the animal kingdom and the remarkably quick changes in the external features of the animal prevent the pupil from losing interest in his study. Moreover abundant opportunity is afforded for cultivating the powers of observation and expression in sketching and describing the numerous phases of growth.

PROTECTIVE COLORS OF ANIMALS

Review of an article by John Burroughs

Attempts at explaining the uses and meaning of natural objects and processes are much more common in nature-study teaching than in elementary science of high schools and colleges, and it is common to find teachers and pupils in search of a use for everything. Perhaps no phase of nature has been the subject of so much attempted explanation as has color, particularly that of animals and of plants in relation to animals. Accepting almost unreservedly the Darwinian hypothesis that colors of many animals play an important part in the life-and-death struggle, we have grown accustomed to finding some correspondence between the color of an animal and that of its environment. We have

found animals closely resembling their immediate environment in color and thereby more or less concealed from our human eyes; and we have concluded that the purpose of the color harmony is protection from enemies. Other animals, carnivorous ones, seem to be hidden from approaching prey. Still others display colors contrasting strongly with the environment and the conspicuousness has been taken to mean warning colors or danger signals associated with qualities unpleasant to enemies. And more interesting than all these, similarity between two animals (*e. g.*, two butterflies) has been given the interpretation that one is protected from enemies by its warning colors backed up by disagreeable qualities which enemies have learned to avoid, and the other is a helpless impostor who by virtue of his resemblance lives on the notoriety of the one whose conspicuous colors are danger signals. Thus the Darwinian suggestions have given us most interesting interpretations, and we have felt confident that we had the reasons why most animals are colored as they are.

And now come the doubting critics and serious questions are raised. For many years biological literature has contained doubts concerning the wide application of the theories of color interpretation as advocated by Darwin and Wallace. Observations in nature have in many cases failed to prove that the life of animals always depends upon colors as the theory demands. Because a harmonious blending of colors is practically concealment from our human eyes does not prove anything so far as animals are concerned. We must know from critical study just how far color relations mean anything in connection with habits of animals; and many biologists have doubted the all-sufficiency of the explanation offered by the color theories, because in very many cases color and habits of life of certain animals are antagonistic so far as the protective theory is concerned.

In a popular article, "Gay Plumes and Dull," in *Atlantic Monthly* for June, 1905, John Burroughs expresses his own doubts concerning the wide application of the color theories, and many of his views are quite in line with criticisms pointed out by biologists within recent years.

First, Mr. Burroughs points out that "nature plays fast and loose" with colors. One animal has concealing colors and another similar one, often of the same family and even the opposite sex, is conspicuous by its brilliance. "If dull colors are pro-

tective, then bright colors are non-protective or dangerous, and one wonders why all birds of gay feather have not been cut off and the species exterminated."

Second, neutral concealing tints are protective from the point of view of the human eye, but many of the most destructive predaceous animals depend upon scent to locate their prey. Birds of prey are not fooled by color disguises. White rabbits are concealed on snow and gray ones are conspicuous, but where is the advantage since their natural enemies—foxes, minks, weasels, owls—hunt at night? There are numerous similar facts which make us feel decidedly uncertain concerning this phase of the color theory.

Aggressive coloration (concealment from prey) is also capricious. "Why should the owl, which hunts by night, be colored like a hawk which hunts by day?" "The lion is desert colored too. Is this for concealment from its prey? But it is said that horses and oxen scent the lion long before they can see him, as doubtless do the wild creatures of the desert upon which he feeds. Their scent would surely be keener than that of our domesticated animals, and to capture them he must run them down or ambush them where the wind favors him."

Warning colors or danger signals are likewise variable. The skunk's contrast of black and white is said to be of warning value; but why does the porcupine, who is able to compete with the skunk in making life disagreeable for his attacking enemies, not have warning colors also?

Concerning concealment of nesting birds and their nests, Mr. Burroughs thinks that this is not for the sake of the mother birds, but for the sake of the eggs or helpless unfledged young. The obscure color of the female tanager, cardinal and similar birds plays no part in protecting her from crows, weasels, hawks, etc., which explore trees looking for young birds. The enemies of the ground builders hunt at close range and capture, not the nesting female, but the eggs and young.

Materials for nests are not chosen for protective colors, as we have fancied. Anyhow, could marauding crows, jays or squirrels be deceived by nests which to our eyes seem to be protectively colored?

The brilliant colors of many males are, according to Darwin's theory of sexual selection, to be attributed to the selection by the

females. But here also numerous observed facts have long caused many biologists to doubt; and Mr. Burroughs thinks that "it is incredible that the taste of females in fashions, their preference for the gay and the ornate, should have played any considerable part in superinducing these things."

Thus far in his line of questioning the general applicability of the color theories Mr. Burroughs is in line with suggestions by various students of evolution. That colors may play some part in the struggle for existence is still generally accepted by biologists, but there are few who do not recognize the difficulties in explaining such facts as Mr. Burroughs cites. The question now is, How far are the color theories applicable? More than ever before we need to study animals in nature as well as in the laboratory.

But if the remarkable color resemblances which we see around us do not mean adaptation which is valuable in the struggle for existence, what is the explanation? This is the question which Mr. Burroughs faces. He is "more disposed to regard them as the result of the same law or tendency that makes nature in general adaptive and harmonious; the outcome of the blendings, the adjustments, the unifying processes, or tendencies, that are seen and felt all about us." This is interesting, but really only another way of stating the observed facts which originally suggested to men of science the color theories as an attempt to give the reason why there are blendings and adjustments in nature. A "tendency to oneness" is not the answer wanted. If the color theories do not explain a particular case of animal color, then at present we might as well confess that we do not know. This we have long done in the case of the gorgeous hidden colors of molluscan shells and the details of color patterns of insects and birds.

Nature-study teachers will certainly do well to continue calling attention to the colors of animals as related to their surroundings, and suggest investigation concerning the effectiveness of the color; but as a general principle it does not seem wise to state that harmonious blending means protection and contrasts are danger signals. At least we must be somewhat cautious until our information is less open to question.

With colors as with so many other things touched in nature-study of schools it seems best to keep close to observed facts

and not worry much about why and what for things are as we see them. Thus we will avoid the perplexing situation caused by the boy who added a climax to the lesson on the use of blackberry prickles by remarking that pigweeds got along and flourished without prickles as protection from grazing animals.

M. A. B.

DISCUSSION AND CORRESPONDENCE[1]

Facts Discovered by Children. I was astonished to read the following sentence quoted with approval in THE REVIEW, p. 132: "To-day it is almost beyond the bounds of human possibility that a child should discover an unknown fact in the sciences, and the thought that he can do so will either engender in him an arrogant self-conceit, or it will entail a cruel awakening which may convince him that all effort on his part is useless."

So far is this from being true, that in some subjects, at least, it would be quite impossible for him to avoid discovering new facts. Take, for example, the relations between insects and flowers. In this country comparatively little work has been done in this branch of study, and it is safe to say that there are several hundred species of plants at present blooming in the vicinity of New York, the insect-visitors of which have never been observed. Even in the case of those which have been studied, almost none have been observed in that locality, and without doubt new observations there would yield new facts of interest. It may be true that the children have no time, as a general thing, to make such observations; it may be true that few of the teachers are competent to direct them therein; but it certainly is not true that the facts themselves are out-of-reach or difficult to observe. Of course it would be necessary to send the insects to specialists to get them named; but Hermann Müller, the author of the greatest work on the fertilization of flowers, had to do this very thing.

So again, there are at this moment flying in and about New York hundreds of species of bees and wasps, and the nesting of the great majority is unknown. With the work of the Peckhams as a guide, there is no reason why any intelligent person, young or old, should not discover numerous new facts. It takes time, and it needs patience; and it is necessary to have the coöperation of some one who really understands the subject; but the door is wide open for those who care to enter.

[1] The announcement of this department was published in No. 1, January, 1905.

It is of course true that not very many children have the zeal and perseverance to accomplish a good piece of research; not many, for instance, will sit for an hour in the hot sun watching a wasp provision its nest. Yet I am inclined to think that under favorable circumstances, and with suitable direction, the number of children who would and could make careful observations is greater than the number of adults. In such subjects as I have mentioned, where broad results must be based on exceedingly numerous observations of a comparatively simple character, I do not see why a considerable portion of the necessary facts might not be gathered by children of high-school age, and even younger, acting always in a coöperative manner and under direction.

I may add that as a matter of facts I have learned much from specimens and information supplied by the young people I have had to do with, as is duly recorded in my various published papers.

T. D. A. COCKERELL.

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BOOK REVIEWS

Experiments with Plants. By W. J. V. Osterhout. New York, Macmillan. 1905. Pp. 493, figs. 250.

Professor Osterhout's book, "Experiments With Plants," begins with two excellent chapters giving directions for experiments on the germination of seeds. Then there follow chapters on the work of roots, of leaves, of stems, of flowers and of fruits. A general chapter on the influence of environment upon the growth of plants; one on fungi, particularly bacteria, molds, rusts and smuts; and a final one on the modern methods of plant breeding complete the book.

The book, according to Professor Bailey's preface, is intended to supplement the latter's "Botany" and "Lessons With Plants," suggesting and explaining problems for experimentation. It is not arranged, however, to serve especially as a laboratory manual, for the experiments are not separated from the text and the chapters also contain much information in addition to the experimental work. In the chapter on roots there is discussion of soils and the relation of plants to soil and to water, bringing in the agricultural side of plant natural history. The structure, both internal and external, of roots, leaves and stems is rather thoroughly

examined and directions are given for preparing the necessary materials for study. It is the function of the parts, their "work" as members of a living organism which is, however, constantly made prominent.

The book may be used, the author states, by both teacher and pupil. For the former we should heartily recommend it. As a text or reference book for college or high-school classes it is also excellent, though it would doubtless have to be used with omissions, for the experiments are very numerous and go into a good deal of detail. They are planned to use only familiar and simple materials, and the object and results are made as clear and definite as possible. Certain ones, therefore, selected by the teacher, could well be used in the nature-study of the elementary school.

The last chapter is especially useful to teachers or advanced pupils in emphasizing the economic importance of experimental work with plants as shown by the labors of Luther Burbank and other horticulturists. The author closes with a brief but clear summary of Professor De Vries' researches and their bearing on important biological problems. A. WATTERSON.

House, Garden, and Field. By L. C. Miall. London, Arnold; New York, Longmans. 1904. Pp. 316, ill. $1.50.

This is "a collection of short nature studies," dealing with a great variety of subjects—*e. g.*, many insects, birds, fishes, spiders, plants, etc. Each chapter is a study of some one form, *e. g.*, glowworm, barnacles, water-lilies, house-flies, banana, herring, monkey, house spider, a chalk hill, grasses, buttercup. In fact, the book is a collection of over fifty talks by a naturalist; and there is no suggestion of a connected series. Taken independently, the talks are all interesting and full of information for general readers. There are certain "studies" in the form of school lessons, but most of the chapters are simply natural-history essays in the familiar style of the author's earlier book entitled "Round the Year." It is primarily a contribution to the literature for encouraging the popular movement for interest in natural things, rather than a book for the direct use of teachers who want guides for school work. Of course, like popular natural histories, this book will help the teacher in getting the fundamental information about common things with which school nature-study must deal.

How to Keep Bees. By Anna Botsford Comstock. New York, Doubleday, Page. 1905. Pp. 228, 32 pages photographic illustrations. $1.00

There are numerous guides to bee-culture but most of them are adapted to the reader who has already learned something about bees in the school of experience. For the beginner who wishes to learn the essential details from reading, this is certainly the book to be obtained first. "It is not intended to be a complete treatise for the professional apiarist, but rather a handbook for those who would keep bees for happiness and honey, and incidentally for money. It is hoped, too, that it will serve as an introduction to the more extended manuals already in the field." Especially commendable is the fact that this volume is based on practical experience gained in a small apiary, and the disputed points concerning bee life and the technique of manipulations which burden larger manuals are here avoided.

Chapter I, "Why keep bees," urges honey, perhaps money, recreation, love of nature-study, and the need of bees in "a perfect garden," as good reasons for keeping these domesticated insects. The second chapter tells us "how to begin" in a small way; and having begun we may get all necessary detailed directions for management from later chapters, arranged in order of demand for information. It appeals to the reviewer as just what the beginner wants to know.

This brief review would be incomplete without referring to the literary qualities of the book. It is all interesting, and the plain facts are far from prosaic technical directions. As examples we quote: "A bee-veil facilitates work and encourages a serene spirit," "bee-gloves keep the disturbed little citizens from crawling up our sleeves, thus saving both them and ourselves from a most embarassing situation," and "a little smoke is as efficacious in preserving pleasant relations with the bees, as was the smoke from the pipe of peace in preserving similar relations between our forefathers and the savages."

Moths and Butterflies. By Mary C. Dickerson. Boston, Ginn. 1905. Pp. 344, 200 photographs. $1.50.

The publishers' announcement that this book was in preparation raised the question, "Why should there be printed another book on Lepidoptera in addition to the thousand and one already in the

field ?" But an hour spent in reading this new book by Miss Dickerson, of the Rhode Island Normal School, convinces that it fills an unoccupied place in the popular literature on these most popular insects. Here we have in a book of convenient size more of the kind of information wanted by the average beginning student than can be found in any other two volumes. We have other good books on common butterflies, *e. g.*, Comstock's "How to Know the Butterflies," Scudder's "Everyday Butterflies," and Holland's "Butterfly Book," and on moths we have Holland's "Moth Book" and Eliot and Soule's "Caterpillars and their Moths"; but no recent volume including both types of the lepidopterans. Ballard's "Moths and Butterflies" has for many years been popular, but in illustrations and contained information it does not meet the needs of readers who are attracted to books like those named above. Dickerson's "Moths and Butterflies" has many of the characteristics which have made the books by Comstock, Scudder and Holland popular, and for the average beginning student of these insects the book may take the place of any two volumes named above, because it gives special attention to about a dozen butterflies and as many moths which are most common, and therefore best for beginning study. The two hundred photographs from life make it possible to identify caterpillar, chrysalis or cocoon, and the adult stage. The book closes with a very practical chapter on how to collect, keep, and study butterflies and moths. This will be especially useful to teachers of nature-study in September and October.

GUIDE TO PERIODICAL LITERATURE

A BIBLIOGRAPHY OF THE LEADING MAGAZINE ARTICLES OF INTEREST IN CONNECTION WITH NATURE-STUDY
APRIL TO JULY, 1905

ARRANGED BY ADA WATTERSON

Tutor in Biology, Teachers College, Columbia University

[EDITORIAL NOTE.—The bibliography for the year 1904 and to April, 1905, has been published in No. 1, No. 2 and No. 3 of THE REVIEW. See any of these also for statement of the aims and explanation of this bibliographical guide.]

1. EDUCATIONAL AND GENERAL DISCUSSIONS OF NATURE-STUDY

Jackman, W. S. Nature-study and religious training. Educ. Rev. **30**: 12–30. Je. '05.

Latter, O. H. Biological side of nature-study. I. Plant life. School World. (Eng.) **7**: 123–5. Ap. '05. (Materials and methods.)

Nature work with sciences in the kindergarten. Kind. Mag. **17**: 549–51. My. '05.

Term plans in nature-study for the spring term. (Arranged according to grades.) School Work. (N. Y.) **14**: 1–19. Ap. '05.

Wolcott, R. Nature-study. School Science. **5**: 316–21. My. '05. (Aims and methods.)

2. NATURAL HISTORY OF ANIMALS AND PLANTS

I. ANIMALS

GENERAL

Beard, D. How to make a land and water aquarium. Outing. **46**: 115–7. Ap. '05.

Burroughs, J. Are animals sympathetic?—Protective coloration. Outing. **46**: 247–8. My. '05. Gay plumes and dull. Atlan. **95**: 721–37. Je. '05. (Protective coloration of animals.)

Mackenzie, M. Nature notes. Dept. in Kind. Rev. **15**. Ap. '05.

Rabbit, Peter (pseud.). Do animals think? Harper. **111**: 59–62. Je. '05. (A criticism of Burroughs' opinions.)

INSECTS

Comstock, A. B. The workers in the hive. C'try Life in Amer. **8**: 215–17. Je. '05.

McCook, H. C. Huntress wasps. Harper. **110**: 894–9. My. '05.

Sharp, D. L. Spring cleaning with the bee-keeper. Country Cal. **1**: 24–6. My. '05.

Stene, A. E. The gypsy moth. Nature Guard (R. I.). Lesson 42. My. '05. Pp. 173–6.

LOWER VERTEBRATES

Burroughs, J. Fatal spawning. Outing. **46**: 371–2. Je. '05. (Lamprey eel.)

Geare, R. I. The cobra. Sci. Am. **92**: 420. My. 27, '05.

BIRDS

Chapman, F. M. Photographing flamingos in their rookery. C'try Life in Amer. **8**: 41–4. My. '05.

Comstock, A. B. Beginning bird study. Chaut. **41**: 259–63, 369–74. My., Je. '05.

Davis, J. E. Some birds useful to the Southern farmer. Hampton Leaflet. **1**, No. 4. Ap. '05. Pp. 12. Also published in Southern Workman. **34**: 342–9. Je. '05.

Dutcher, W. The American barn owl. Bird-Lore. **7**: 185–8. My. '05. (Audubon Educational Leaflet 14.)

Finley, W. L. The golden eagle of Mission Ridge. Country Cal. **1**: 41–6. My. '05. Humming-bird and her home. **1**: 136–9. Je. '05.

Fuertes, L. A. Birds at home. (Nesting habits.) St. Nich. **32**: 744–6. Je. '05. The return of the birds. (Migration.) **32**: 648–9. My. '05.

Hegner, R. W. Nature studies with birds for the elementary school. Ele. School T. **5**: 408–18, 462–72. Mr., Ap. '05.

Job, H. K. The extermination of the egret. C'try Life in Amer. **7**: 627–9. Ap. '05.

Lottridge, S. A. The bluebird. St. Nich. **32**: 610–13. My. '05. The great horned owl. **32**: 530–5. Ap. '05.

Scott, W. E. D. Turtle-dove: a story of meadow-larks. Outlook. **80**: 325–9. Je. 3, '05.

MAMMALS

Barney, C. W. The use of dogs in war. Scribner. **37**: 689–97. Je. '05. (Red Cross aids after battles.)

Burroughs, J. A beaver's reason. Cosmo. **39**: 216–22. Je. '05. The miraculous beaver. Outing. **46**: 118–9. Ap. '05. The rabbit's most bitter foe. (Weasel.) Outing. **46**: 371. Je. '05.

Comstock, A. B. The cow. Chaut. **41**: 166–71. Ap. '05.

Hutchinson, Woods. The weapons and tools of the dog. Open Court. **19**: 205–26. Ap. '05.

Lottridge, S. A. Photographing a wild fox. St. Nich. **32**: 721–4. Je. '05.

Seton, E. T. Secrets of the trail. C'try Life in Amer. **8**: 202–5. Je. '05.

II. PLANTS

GENERAL

Beal, W. J. Plants that hide from animals. Pop. Sci. Mo. **67**: 178–83. Je. '05. (Adaptations to environment.)

Beeson, E. B. The miracle maker of gardens. Ind. **58**: 997–1004. My. '05. (Luther Burbank.)

Brainerd, E. B. Lesson on the wild carrot. N. Y. Teachers' Mono. **7**: 46–7. Mr. '05.

Cook, M. T. Tropical fruits. I. The banana. School Science. **5**: 478–80. Je. '05.

French, F. The brook. Harper. **110**: 691–8. Ap. '05.

H., E. B. How some flowers got their names. St. Nich. **32**: 725–31. Je. '05.

Harwood, W. S. A wonder-worker of science. Cent. **69**: 821–37. Ap. '05. Every man his own Burbank. Country Cal. **1**: 21–3. My. '05.

Sharp, D. L. Birds and flowers of June. Country Cal. **1**: 133–5. Je. '05. Woods and meadows in May. **1**: 32–5. My. '05.

TREES AND FORESTRY

Beede, V. V. M. Legends of the trees. Chaut. **41**: 306–11. Je. '05.

Brown, J. P. The Catalpa speciosa. Chaut. **41**: 364–8. Je. '05.

Foster, E. W. Our friends the trees. St. Nich. **32**: 577–83, 703–8. My., Je., '05.

French, F. The awakening of the trees. Scrib. **37**: 597–603. My. '05.

Hall, Mrs. H. J. Some historical trees. Chaut. **41**: 316–18. Je. '05.

Harger, C. M. Foresting the prairies. World's Work. 10: 6255–61. Je. '05.

Hawes, A. F. Trees and forests and how to plant them. Prim. Educ. 13: 164–5. Ap. '05.

Hegner, R. W. Program for arbor day. Ele. School T. 5: 468–72. Ap. '05.

McFarland, J. H. The awakening of the trees. Outlook. 79: 803–10. Ap. 1, '05.

Millspaugh, C. F. The story of a tree as told by its log. Chaut. 41: 303–6. Je. '05.

Millspaugh, Mrs. C. F. Tree protection in the United States. Chaut. 41: 326–34. Je. '05.

Rogers, J. E. Dooryard trees. Prim. Educ. 13: 168. Ap. '05.

Songs of the trees. (Four, selected.) Chaut. 41: 362–3. Je. '05.

Suter, H. M. Fighting forest fires. Chaut. 41: 348–54. Je. '05.

List of available publications of the Bureau of Forestry, U. S. Dept. of Agric. Chaut. 41: 378–9. Je. '05.

3. AGRICULTURE, INCLUDING GARDENING

Bailey, L. H. Some present problems in agriculture. Science. 21: 681–9. My. 5, '05. Quest of nitrogen. Country Cal. 1: 27–8. My. '05.

Barron, L. Planting-table for flowers. Garden Mag. 1: 117–8. Ap. '05.

Casey, D. V. Unconventional veranda and window-boxes. Garden Mag. 1: 228–9. Je. '05.

Cromwell, A. D. Should elementary agriculture be taught in the public schools? Pop. Educator. 22: 381–2. Ap. '05.

Fullerton, E. L. Planting-table for vegetables. Garden Mag. 1: 110–3. Ap. '05. Thinning and transplanting vegetables. Garden Mag. 1: 174–6. My. '05.

Fullerton, H. B. Gardening tools and implements. C'try Life in Amer. 7: 634–5. Ap. '05.

Gillan, S. Y. Lessons in elementary agriculture. Amer. Jour. of Educ. 38: 300–2. Ap. '05.

McAdam, T. The best tall perennials. Garden Mag. 1: 119–21. Ap. '05.

Maynard, S. T. Spring work in the garden. Outing. 46: 92–101. Ap. '05.

Mumford, H. W. Study of animal husbandry. School News. 18: 360–3, 422–5. Ap., My., Je. '05.

Rogers, J. E. A wild garden at school. Pop. Educator. 22: 383. Ap. '05.

Sutherland, A. Farming vacant city lots. R. of Rs. 31: 567–71. My. '05.

4. PHYSICAL NATURE-STUDY

Friedman, H. Earth study: the classification of minerals. School Work. 3: 396–400.

Grosvenor, G. H. Our heralds of storm and flood. Cent. 70: 161–78. Je. '05. (Work of United States Weather Bureau.)

NOTES ON RECENT PAMPHLETS AND MAGAZINE ARTICLES

Primer of Forestry. This important bulletin by Pinchot, director of the Bureau of Forestry, is now available in the complete form, Part I having been reprinted and Part II recently issued. Part I deals with the general principles of forestry and Part II with practical management. The price, cloth binding, is 35 cents for each part; for sale by Superintendent of Documents, Washington, D. C. An extract of Part I is also published as a Farmers' Bulletin for free distribution (apply to Secretary of Agriculture).

Maple Sugar Industry. An interesting pamphlet of 56 pages has been published by the U. S. Dept. of Agriculture. It treats of sugar making by the Indians, white settlers, and recent improvements; the various kinds of maples; the management of sugar groves; maple sap; and adulterations. The pamphlet will be useful to teachers who refer to maple trees. The price of the pamphlet is 5 cents; for sale by the Superintendent of Documents, Washington, D. C.

Key to Forest Trees, based on their leaf characters, has been prepared for Indiana by Professor Stanley Coulter and H. B. Dorner, of Purdue University. The pamphlet of ten pages is very convenient and could easily be modified to fit trees of other states.

Cleveland Home Gardens. The fifth (1904) report of the Home Gardening Association of Cleveland, Ohio, indicates continued progress in the work of that organization. The sale of seeds alone is a good sign of the extent of the movement; 237,393 packages of seeds and bulbs, 57,857 to schools outside the city. Four gardens for schools were established, and this work is being extended during the present summer. As in former years, flower shows aroused great interest; and shows were held in forty schools. Many more citizens have been persuaded that the work is valuable and their contributions of money and of land for gardens have aided in extending the work. Those interested in home gardens—and every city and town should have an organization for encouraging gardening—will find the fourth and fifth reports of the Cleveland Association helpful and, in fact, indepensable. They may be obtained from President E. W. Haines, 262 St. Clair St., Cleveland, O. Twenty-five cents per copy should be sent.

Boys' Agricultural Clubs. A circular with this title is Extract No. 362 from the 1904 year book of the Department of Agriculture. It describes an interesting phase of the great movement forward in agricultural education. It is interesting to learn that in Illinois, Ohio, Iowa and other states of that region the boys have many well organized clubs for study of farm problems and that they take full

charge of special sessions at farmers' institutes. We see in the clubs another way of teaching agricultural nature-study. The pamphlet is free; apply to the Secretary of Agriculture.

Photographs of Wild Game. Some of the most interesting photographs of large animals living under natural conditions are those of elk reproduced in the September *Country Life in America*. One photograph includes fifteen hundred of these animals, which in enormous herds are said to be making their "last stand" in a great valley of the Rockies, to which 20,000 to 40,000 come from the mountains to pass six months of winter.

Non-Stinging Bees. The Caucasian bees imported from Russia in 1902 by the U. S. Department of Agriculture are said to be so gentle that they rarely sting; and a writer in the September *Country Life in America* thinks that they will surely take the place of other races, even the Italians and Carniolans which in gentleness are children's pets in comparison with the common brown German bee which our forefathers spread throughout this country.

NEWS NOTES

Nature-Study in New York City. The daily papers report that the Board

directed by Professor Stanley Coulter, of Purdue University. Mrs. Comstock, of Cornell, conducted courses at the University of California. Professor Hodge, of Clark University, lectured at the Connecticut Agricultural College and at the Macdonald Institute of Ontario. Dr. E. F. Bigelow, of *St. Nicholas*, lectured in Michigan Normal Schools and at Wooster University (Ohio). Courses relating to nature-study were directed by Professor Stevens at the N. C. College of Agriculture; by Dr. A. J. Grout, of the Boys' High School of Brooklyn, at Hyannis (Mass.) Normal School; by Professor Jackman at the University of Chicago; by Miss Watterson and M. A. Bigelow at Teachers College, Columbia University; and by Professor McCready at Macdonald Institute. Advertisements indicate that very many other summer schools offered special work for teachers of nature-study, but specific information regarding instructors has not reached this office.

Nature-Study in Summer Schools. At Cornell University the work was

of Education has removed nature-study from the required list of studies and placed it on the elective list. The difficulties of getting material, training teachers and overcoming public opinion against "frills and fads" has made the nature-study problem a serious one during the past two years. Obviously, it is not wise to force nature-study suddenly into a complex school system.

Forest Service. This is the new name of the Bureau of Forestry, U. S. Department of Agriculture. In addition to its regular work the service will undertake to encourage teaching of elementary forestry in public schools. Later information on this point may be expected to appear in this journal.

The Teachers College Record

The Teachers College Record is a serial publication issued by Teachers College, Columbia University, for the purpose of presenting the most recent views of the history and principles of education, of educational administration, and of the theory and practice of teaching.

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THE NATURE-STUDY REVIEW

Vol. 1, No. 5 September, 1905

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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FOR THE 1906 VOLUME.

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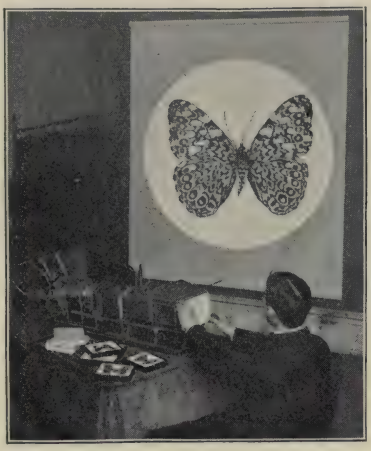
FOR NATURE-STUDY



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THE

NATURE-STUDY REVIEW

DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

VOL. I SEPTEMBER, 1905 No. 5

THE RELATION OF GEOGRAPHY TO NATURE-STUDY IN THE ELEMENTARY SCHOOL

BY HAROLD W. FAIRBANKS, PH.D.

Author of "Stories of our Mother Earth," "Home Geography," "Stories of Rocks and Minerals," etc.

Introduction

It requires but a slight experience with educational problems to discover that there exists a very wide divergence of opinion as to what should be included under the terms *geography* and *nature-study,* and the relationship, if any, which exists between their respective fields. A part of what in one school is called geography is in another included under the head of nature-study. In one school geography and nature-study are taught as though they had nothing in common, while in another they are more or less closely correlated. Still farther, the instruction in nature-study, or science as it is often called, is given from different standpoints and with widely different objects in view. On the one hand it is the informal introduction of the child to the phenomena of his environment, while on the other hand the methods and aims of science dominate the instruction.

There is a wide-spread feeling on the part of teachers that the work in geography does not produce satisfactory results, and the subject has been condemned in some quarters as merely an agglomeration of facts from many unrelated fields; while the progress of the nature-study idea has suffered from the lack of a distinctly formulated purpose or unifying principle to serve as a basis for its expression under varying circumstances in different parts of the country.

It is the object of the present paper to inquire briefly into the existing differences in school practice, determine if there is not ground for a more uniform and rational treatment of geography and nature-study, and express the conclusions reached in an outline course of study. The work involved in the preparation of the paper was under the direction of Prof. E. E. Brown in the Seminary of Education, University of California. All the general literature accessible was consulted, and in addition the courses of study of more than twenty leading cities and practice schools in the United States.

Development and Scope of Geography

Before we can analyze our subject properly and determine the relation which should exist between geography and nature-study we must first inquire into the development and present significance of each.

We may define geography as the science of the earth as an organic whole whose parts are continually reacting upon each other. The materials of geography, drawn from all the sciences, are not combined as in a mosaic, but are interwoven in a new synthesis of a higher order. The study of the phenomena of the air, of the ocean, and the origin and meaning of land forms, is not undertaken for the purpose of furthering the sciences of meteorology, oceanography, and geology; but rather, that we may understand the part which each of these subjects plays in the complicated inter-actions between physical forces and life. When plants and animals are studied with the object in view of discovering their nature and affinities the work is properly biology, but when we seek to find out their part in the general economy of the world it becomes geography. Any fact which is looked at from the standpoint of its earth relationships may be properly included in a discussion of geography.

Geography has been called a composite of many unrelated sciences, a dumping ground for vagrant facts, a relic of medievalism, but from the standpoint given above its individuality seems as real as that of any other subject.

Geography, as the name signifies, was originally descriptive. The earth and its inhabitants were supposed to be parts of a fixed system and order of things, and no other method but that of description was possible. Now we know that perpetual change and adjustment is the law of the world. No branch of learning

can be considered scientific which does not attempt to discover the laws of these changes, to discover the laws of cause and effect under which all phenomena follow each other in orderly succession.

Geography, then, is comprehensive, dealing not only with the earth-relationships of facts as they are now open to observation, but in seeking causes and consequences in an attempt to arrive at a rational conception of them, reaches back into the past and forward into the future.

Geography has its special standpoint and problems of its own to solve, just as have geology and biology; and because it necessarily draws upon these sciences for a portion of its materials, we must not look upon this fact as weakening its individuality. Physical geography is not geology in disguise, for although in the study of the meaning and origin of earth forms it deals with a part of the same materials as geology, yet it has a very different end in view.

Geography as thus defined is a science and worthy of the prolonged investigations of the advanced student, while in its non-technical elementary stage, it is of all studies in the curriculum, the most important as giving an outlook over the world, and a general view of the phenomena with which the life of every one is intimately bound up.

Historically, geography formed the starting point of many of the sciences. Its content was at first ill-defined and it embraced much that was mythological and legendary. From this undifferentiated beginning one science after another has grown up and gone on its independent way, while at the same time the real problems of geography, as well as its scope, have become more clearly defined.

The child in his mental growth goes through in epitome the history of the race. He is first interested in folk-tales and nature myths and in getting answers to the meaning of things about him. Then he wants to know about people and things in other parts of the world, and finally undertakes with definite purpose to widen and deepen his knowledge and to establish principles of universal application.

Geography proper begins in the elementary school with an attempt to grasp the obvious relations exhibited by the earth, the sky, water and the living things in the local environment. As

the years pass the subject is viewed in its wider relations, it becomes better defined and its purposes more consciously in view. There is just as much difference in method and object between the geography of the primary school and that of the university as there is between nature-study and science.[1]

What is Nature-Study

Educational leaders have voiced for three hundred years the importance of going directly to nature for our knowledge of her, rather than to books. This thought has been partly expressed in geography teaching in the growing attention paid to the study of the home. It also appeared in object teaching which was so prominent in the schools a generation ago. The influence of the older *natural history* and the expansion of science in recent years in the college and high school has also had a very important effect upon the attention paid to the study of nature in the elementary school.

Although object teaching was too often formal and lifeless, yet it seems to have furnished the fundamental conceptions of the nature-study of today, and that is the placing of emphasis upon the general culture of the pupil rather than upon the acquisition of facts. The influence of the science teaching of the higher schools was however in the opposite direction. It frequently introduced quantitative and analytic methods of mature minds believing that nature could be profitably studied only in this manner. It tried to bend the children toward its own methods, rather than to adapt them to the children; so that the latter have often been set at the study of natural phenomena from a standpoint which was far beyond their understanding. The consequence was that interest disappeared and the study lost all its value.

In the place of the formal methods of object teaching, and the more precise and exact methods of science, there has grown up the conceptions covered by the modern term nature-study. This, although in practice still ill-defined and often poorly worked out, contains some fundamental truths which place it far in advance of the earlier efforts.

Although discarding the ways of science, nature-study does not thereby become unscientific. It merely adapts its methods to the needs of children. If we would develop in them an intelligent

[1] See discussion in this journal, No. 1, January, 1905.—Managing Editor.

interest in their environment we must go at it from their standpoint. We may look at the child as a possible future scientist, but that should not affect our present method of treating him.

It is generally agreed that the materials of nature-study, except perhaps in the upper grammar grades, should be drawn from what is actually open to observation and experience on the part of the child. These must not be trivial, but such as appeal to his sense of worth and value. In choosing the material, it is well to recognize the fact that there are certain aspects of life which are particularly interesting to young children; while on the other hand there are many physical facts which are taken up to better advantage in the upper grammar grades. There is, however, a vast fund of materials, both of organic and inorganic nature, suited to any grade. Much depends upon adapting the method of treatment of these materials to the degree of development of the child.

There can be no one course of nature-study suited to all schools, since we are to deal with materials at first hand, and these are not the same in any two districts. Notwithstanding these differences there is a common ground upon which all teachers can meet, and this is the attitude assumed toward nature.

The child is naturally alive to what is taking place about him. The work in nature-study directs these interests along rational lines and toward some end. Interest should be consulted at every step, but not blindly followed by the teacher. In many cases interest must be aroused in children whose home influences have been such as to dull their natural and spontaneous delight in things about them.

In each school there must be a definite system or plan based upon the surroundings and upon the age and capacities of the pupils. The special interests of the teacher must also not be neglected. It is not important that every phase of nature in the neighborhood be touched upon. It is important however that every topic taken up have a vital living interest for the children as well as for the teacher. It is only thus that good will come of this work.

Nature-Study and Science

The courses of study consulted in the preparation of this paper reveal the fact that much confusion exists as to the use of the terms *nature-study* and *science* in the elementary school. In some

cases they are used as though synonymous. In some one of the terms is used throughout the course, and in several the work is spoken of as nature-study in the primary grades and as science in the grammar grades.

While the science in the higher schools has to do with the same phenomena as the nature work of the elementary school, are the methods and aims the same in both cases? Is nature-study another name for elementary science? Is it merely science made simple, or does it express a fundamentally different conception and aim?

An examination of the leading educational movements which have been concerned in the development of the modern nature-study idea would aid in answering these questions, but it cannot be entered upon in detail in the present paper. It must suffice to say that the influence of "object teaching" was in the direction of the general training of the mental powers, while that of college and high-school science fostered exact and systematic methods.

Modern nature-study takes what is best in both these movements. It is less formal and artificial than object teaching, and attempts to lead the child directly to nature, rather than to take nature to the child. The first thought is to bring about a familiarity with, and a love for the world about us, and to develop in the pupil self-reliance, reason and judgment in the presence of the various physical problems of actual life, instead of presenting abstract problems for solution.

A simple understanding of the meaning of the common facts about us as they are related to our every-day life is very far from being consciously organized and classified knowledge. The former is suited to the child's needs, his capacities and his interests. Science as such does not appeal to him, and the attempt to use its methods has brought the study of nature into disrepute in numberless instances. One cannot help but be impressed while examining courses of study from all over the United States, with the feeling that many of them have been planned from the standpoint of the scientific student rather than from that of the child. The courses are filled with a multitude of topics from every science, as though the number presented was the important thing. It seems as though the idea was widely current that it would not do to let the child leave the grammar school without having

been crammed with facts about every conceivable phenomena of nature, whether of any worth and interest to him or not. This we may truly call dabbling in science. It is poor science and does not deserve the name of nature-study.

The lack of mental development and training on the part of the pupil precludes the methods of science in the elementary school. The study of natural phenomena for the purpose of classification and the formulation of law will come in its proper time, but it is sufficient for the pupil of the grammar grade to interest himself in and become familiar with the facts of nature about him without attempting a formal organization of his knowledge.

Nature cannot be studied from exactly the same standpoint in the grammar grades as it is in the primary, while in the high school and college, methods must be still different. Our school periods are purely artificial divisions, and we cannot say that nature-study pure and simple stops with the eighth grade and science begins with the first year in the high school. The grade should determine the manner in which the problems of nature are taken up. The methods of nature-study of the upper grammar grades must logically blend into the science work of the high school with no break between them. It follows then that much of the work in the high school cannot be as formal and scientific as the work in the college or university.

What the pupils need in the elementary school is to see the concrete side of natural phenomena. A physical principle should not be worked out for its own sake as in the advanced schools, but as an illustration of some fact or experience in the pupil's own life. In short physics as physics has no place in the grammar school, botany as a formal analytic study is out of place, and so with similar phases of other sciences. It would also be much better if the history work in the grades was less formal and closely interwoven with the geography throughout the course. Any method which tends to relate facts as they are related in actual life adds to the vitality of the work of the elementary school.

The plan of the work of the grammar grade should be such as to enable the pupils to get the most out of nature from both the aesthetic and practical standpoints on the supposition that their schooling ends with that period.

Geography and Nature-Study

Geography, as we have seen, should begin with facts open to observation in the home district, and the pupils when thoroughly grounded in the meaning of the relations existing there are then prepared to extend their studies intelligently over the world.

One of the first principles of nature-study is that it shall deal with facts open to the personal experience of the pupils, and these are necessarily bound up with his home surroundings. Geography and nature-study then, in the earlier years of school life, deal from the same standpoint with practically the same materials. For the first three years, at least, we cannot differentiate them in practice. Possibly in the fourth year it may be best to do so, although even here both subjects continue to deal with the home, but from somewhat different standpoints.

There appears to be a deeply rooted tendency, in planning courses of study for the elementary school, to separate closely related facts in order to make them fit into our artificial systems. The child sees things as wholes and understands much better if related facts are presented in their natural associations.

Another mistake constantly made is to expect too much of young children in the way of forming ideas and mental images of what is outside of their experience. How can we expect them to comprehend world relations, or to make other than parrot-like responses before they understand the meaning of similar relations in the little world about them. The fifth year is certainly early enough to begin the formal study of the earth as a whole, although this is far from implying that all reference to the world as a whole be omitted up to this point. Through nature-myths, folk-tales, stories of children and life in other lands the pupils will imbibe incidentally general notions which will form a setting for the more advanced work when they are advanced sufficiently to take it up. Even after general geography has been begun the home must still continue to be the datum mark to which the pupils will constantly refer for comparison what they are attempting to learn about similar relations elsewhere.

This undifferentiated work of the first four years, through which the pupils come to understand their surroundings, we may call either home geography or nature-study, preferably the latter, for it conveys a wider and more generalized meaning. It would be better still if we had a comprehensive term similar to the Ger-

man "heimatskunde," or "home-lore" as it has been translated.

The criticism that geography is a mere jumble of facts from different sciences and that to modernize the subject these should be segregated in primers, each dealing with a particular science, is wrong in theory and has been shown to be so in actual practice. Geography, as we have seen, has a definite content and a particular purpose to fulfil. If we separate its component parts we are destroying the subject and the higher outlook upon the phenomena of the earth which their synthesis affords us.

Marked differences in practice exist in different cities of the United States as to the time of beginning geography, although nature-study wherever taught is usually found in the first grade. In Chicago the two subjects are combined for the first three years. In Boston and New York nature-study begins in the first grade and geography in the fourth, while in the former city the study of natural phenomena from the fourth grade upward is termed "elementary science." In the Horace Mann School of Teachers College, New York, work under geography is begun in the third grade. The University Elementary School of Chicago closely correlates both geography and nature-study throughout the course. It is probable however that the differences in practice are not as great as they appear upon paper, for much that is really geography is often included under nature-study.

Beginning with the fifth year, geography has to do mainly with facts beyond the experience of the pupil, while nature-study is still largely confined to the home district. It is apparent that as a usual thing little attempt is made in arranging courses of study to correlate nature-study and geography. After the two have separated at the beginning of the grammar-school period it is evidently not possible to make a complete correlation because the fields covered are not the same, and yet, these studies are nearly related and should be made to harmonize and mutually support each other as far as possible. Such an arrangement would aid in giving a plan to the nature-study work, for the lack of system has been a partial cause of the frequent failures.

Such topics from the home district as the relation of the climatic conditions to the features of the land, to bodies of water, to the direction of the wind, etc.; the relation of plants and animals to their environment; the dependence of man upon the various physical conditions about him; are phases of nature-study

from one point of view, while from another point of view they are clearly geographic.

The carrying out of experiments in evaporation, solution, and crystallization is nature-study, but when this is done in connection with the study of the great deserts of the world it aids in the acquirement of real geographic knowledge. The deposits of salt soda, borax, and nitre are governed in their formation and distribution by the principles exemplified in the physical phenomena referred to. Numberless other examples could be given if it were necessary, to show how nature-study can support and elucidate the facts of geography.

If the infinite detail, too often present, could be omitted from all courses of nature-study, as well as all those topics which cannot appeal to the child mind, and the work be so shaped, particularly in the upper grades, as to throw light upon the geography the work in both subjects will be made more satisfactory.

Nature-study dealing with the phenomena of our environment; geography beginning with the same phenomena, but ultimately extending its scope to take in their world relations; and history, the development of man under various physical and sociological conditions; should be considered as practically one subject in the earlier half of the elementary-school course, and as closely related subjects in the later half. Although we are still very far from being perfect in practice, yet one important step has been gained in the growing consciousness that the only way in which the child can gain any real benefit from his study of the facts of the phenomenal world is to deal with them in their natural settings.

With the differentiation of nature-study and geography at the beginning of the grammar-school period there are new problems to be solved. How shall the geography of distant regions be treated so as to produce the most distinct and permanent mental images? In the first place we must abandon the method of the present text-books, and cease skimming over the world in a formal and almost meaningless manner. We must, rather, take up the study of the world as a living organism whose parts and functions are mutually dependent.

The relief, climate, the plants and animals of the home district and man's relation to them must be made the starting point for the study of similar things in remote districts that the child has

not visited, and must continue to form a constant source of inspiration for such study, as long as it lasts.

The attempt at memorizing the disconnected facts of geography has generally proved a failure. To avoid this waste of energy these facts must not only be presented in their causal relations, but also in such a manner as to arouse the attention and interest. History, stories of adventure and discovery, current events, and a familiarity with the natural phenomena of the home region all aid in vitalizing the facts of geography.

Geography and History

The intimate relation existing between geography and history is clearly recognized and a close correlation has been worked out in the courses of study of a number of the leading cities of the United States. Because of this fact a discussion of the nature and scope of geography appears to necessitate some consideration of history also.

The legends and myths suitable to the lower grades do not appeal to any particular time or place, but the stories of primitive man carry the children back in imagination to conditions which they love to reproduce in their work and play.

Stories of discovery and of the hardships and adventures experienced by the pioneer settlers of the home region fit in admirably with nature-study and the beginnings of geography.

In the grammar grades there is no good reason why history and geography should not be carried out in parallel courses, each adding interest and enlightenment to the other. The grouping of topics from both subjects about certain central themes gives the mind a better opportunity to grasp and retain them.

The study of the history and geography of a region taken up side by side makes it clear that these two subjects are closely interwoven and that the former in particular cannot be fully understood without a knowledge of its geographic conditions.

OUTLINE OF A COURSE OF STUDY IN NATURE-STUDY, GEOGRAPHY AND HISTORY FOR THE ELEMENTARY SCHOOL

Notes on the Outline of Study

It is hoped that the underlying principles involved in the following course of study will be found in some degree to answer a natural want. It should be recognized, however, that the course is an outline merely, and

that it will have to be filled in and changed more or less to suit the needs of different localities.

The nature-study topics are grouped under a number of heads for the sake of clearness, but this classification should not be carried out in actual practice.

Manual training, hygiene and sanitation, and civics, are related to nature-study and should have a place in a complete course of study.

Little is expected in the way of memorizing of facts, but an earnest attempt is made throughout to group these according to their relations and so build up a connected and rational whole.

Strong emphasis is laid upon the necessity of the pupil acquiring a thorough understanding of the meaning of the maps and relief models of his home region before taking up the study of maps of distant regions. Map drawing as an exercise cultivates the hand and eye and aids in forming mental images of position, but unless this work is based upon facts open to observation the map symbols will appear to the child as little more than so many lines, and a mental picture of the reality for which the map stands will not be formed.

The formal survey of the continents as presented in the text-books is omitted as being of little value, but the geography of history, of industrial expansion, and of current events is important, because through such associations the facts worth knowing become fixed. The geography of current events carried on through the last three years of the grammar school period is quite sure to cover all the important parts of the world.

No abstract or technical work in physical phenomena is recommended, only such problems as are illustrative of the experiences of every-day life.

Nature-Study — First Grade

Institutional and Industrial

Talks about our homes, materials of which they are made. Homes of the first settlers. Homes of the Indians. Stories of primitive life. Building of play homes of various kinds.

Wild animals and fish obtainable in the neighborhood. The natural vegetable products of neighborhood suitable for food, such as fruits, berries, nuts, roots and other parts of plants. Vegetable products which have been introduced.

How men subsisted before the discovery of fire. Advantages of fire. How fire may have been discovered.

How much we depend upon other people for the comforts of life. Talks about doing necessary work with primitive means. Making of clay dishes and weaving of mats from bark or roots or rushes.

Implements used by Indians for killing game, fishing, and for their own protection. Making of bows and arrows.

Various ways of traveling which the children have observed. Traveling long ago.

Stories and poems introducing holidays and festivals.

Biological and Physical

Homes of the smaller wild animals of the neighborhood. The coverings of these animals. The uses to which these coverings are put by man.

Pets kept by the children, comparison of the kind of food which they eat, and their bodily structure and habits. Dogs and wolves. Animal stories. Wild animals once found in the neighborhood. Observation of the habits of a few common birds.

The effect of cold upon animals of different kinds. The effect of cold upon small plants and trees.

Excursions to ponds or streams to observe the living things in them.

Plant several kinds of large seeds and note conditions necessary for their sprouting.

Talks about the plants that children have seen growing that are useful for food, for medicinal purposes, or that are merely ornamental.

Stories about the young of animals.

Nature-myths as introductory to talks about the winds, the storms, and heavenly bodies.

Talks about rain, hail, snow, fog and clouds in connection with the appearance of these phenomena.

Talks about direction, using the magnetic needle.

The gathering of stream or shore pebbles and talks about them.

Nature-Study — Second Grade

Institutional and Industrial

Talks about fishing and the means employed for catching fish by both civilized and primitive peoples. Kinds of fish in the home market and where caught. How fish and other meats are preserved.

Talks and stories about people who live by hunting and fishing. Why such people do not have permanent homes. Conditions of pastoral life. Why we are enabled to have permanent and costly homes.

Continuation of the work of making primitive utensils. Make sun-dried bricks.

Discuss various uses of trees.

Read Hiawatha and discuss his ways and means of doing.

Stories of life and adventure in new lands, especially those dealing with children. Stories of child life in other countries. Stories and poems relating to holidays and the heroes of the nation.

Biological

How animals were domesticated. With aid of pictures and visits to zoological collections, compare our domestic animals with the nearest related wild ones.

Observations and talks upon the familiar animals that store up food. The migrating animals familiar to the children. Chickens and ducks as adapted to different conditions, their food and method of procuring it.

Observations upon the life-history of a silk-worm or other moth; preparation of silk.

Study of an insect such as the ant—its home, food, young. Obtain a colony of ants for study in school.

Observations upon the fish in the aquarium.

Using suitable stories, inculcate sympathetic care for animals.

Prepare a bird calendar.

Gain a familiarity with the more common wild flowers, and their characteristic habitats. Prepare a flower calendar. Teach care for the wild flowers.

The unfolding of leaves and flowers in spring. Methods of dissemination of a few common seeds. The different kinds of trees in the neighborhood, their behavior in winter, their flowers and fruits.

Grow corn and squashes. Prepare corn for eating, using primitive methods. Observations upon sprouting and growing of a horse-chestnut or other similar nut and the use of the "meat" of the nut to the growing plant.

Simple talks and observations upon the differences between plants and animals.

With talks and pictures illustrate how animals in different parts of the earth are adapted to their surroundings.

Talks about the lands to which the birds migrate. Summer homes of geese and ducks.

AGRICULTURAL

Observations in home district as to where plants grow most luxuriantly. Visit vegetable gardens.

Reach conclusions from observations and pictures as to what kinds of products different slopes are best suited for. Seek reasons for conclusion. Talks about the situation of farm houses and buildings.

The preparation of soil for seed. The need of moisture and warmth. Harvesting of crops in the neighborhood. The most important agricultural products. What is done with these products.

PHYSICAL

Continuation of nature-myths and poems.

Poems about the seasons, winds, etc.

Talks and observations upon the weather.

Simple talks about the influence of the sun and the causes for the seasons.

Water and the effect upon it of heat and cold.

Nature-Study — Third Grade

INSTITUTIONAL, INDUSTRIAL, HISTORICAL

Reading of Robinson Crusoe and discussion of his ways and means of doing work.

Study of the customs, implements, and home of some group of Indians or other primitive people represented in some accessible collection.

Pictures and descriptions of the cliff dwellers, their homes, implements, water and food supplies.

Picture writing of savages and origin of writing.

Division of labor now and in primitive times. Leading occupations in the vicinity dependent upon natural resources.

The building materials in the home district, early buildings compared with those now used.

Means of lighting now and long ago; primitive lamps.

Talks about how people govern themselves in savage and civilized conditions. Government of the home district.

Stories of the pioneers and explorers of the home district.

Excursions to landmarks in the vicinity.

Nature-myths, Greek and Norse myths, stories of explorers.

Biological

Study of the harmful insects of the home. Insects affecting plants.

Conditions fostering growth of flies and mosquitoes.

Bees and honey making. Plants most useful to bees.

Continue observations upon the plants of the aquarium. Plants that will grow in water without soil.

Grow from seed several common trees.

Compare tropical plants in greenhouses with native ones as to sensitiveness to cold. Why trees shed their leaves. Condition of plants in the tropics during the different seasons of the year.

Experiments as to effect of light upon plants. Study of a desert plant such as a cactus.

Observations upon the life-history of a frog. The life and habits of frog at different seasons of the year.

Agricultural

Garden work in season.

Make a study of the origin of soil through excursions to road or stream cuts. Separate the clay, bits of rock or sand, and organic matter in soil by washing.

The work of various animals which enrich the soil; artificial enrichment. Plant barley and corn in rich soil, sub-soil, and crushed rock and find out reasons for difference in growth.

Physical

Whale oil, how obtained, use. Petroleum, how obtained, natural appearance, origin. Products of crude petroleum. Talks about different kinds of coal and their origin.

Evaporation and condensation of water, solution of substances to illustrate various facts of every-day life. Manufacture of salt. Story of rock-salt. Visit any quarries or mines in the neighborhood. Talks with specimens of the mining and reduction of iron and copper ores. Uses and properties of these metals.

Careful study of the various uses of the wind. Construct weather-vane. Keep a record of direction of winds during stormy and fair weather.

Mark the movements of the sun from week to week by the shadow of a vertical stick.

Investigate the water supply of the home. Visit springs and reservoirs.

GEOGRAPHICAL

Origin of trade and commerce. Note from a study of the home district how slopes of the land and position of waterways influence travel, and the position of the roads.

If we had only what was produced in the neighborhood, what would we have to do without.

During winter study life in cold regions, in summer that in warm regions, discussing homes, dress, food and ways of traveling.

Observations upon the effect of rain-water upon unprotected surfaces. Note the character of stream channels and whether they flow in broad or narrow depressions. Distinguish the various land and water forms within reach. Make a rude model of the home region in sand or clay.

Develop notion of a map by first studying the relief of the district familiar to the children, then pictures showing the same, and finally a relief model of it. From this lead to the conception of a map by drawing to scale the relief model, and comparing sketch with the real landscape studied.

Continue work upon known material until the children are conversant with the meaning of a plain map of the home district and its various symbols.

Talks about the important physical features of the state with aid of pictures and descriptions, including stories of travel and adventure. Compare features portrayed with those of the home region.

Discuss the products of the various parts of the adjoining region or the state with aid of pictures and compare results with what would be expected from the study of the features of the home region. Give reasons for different products and occupations upon different kinds of land surfaces.

Nature-Study — Fourth Grade

INSTITUTIONAL, INDUSTRIAL, HISTORICAL

Stories of the lives of some of the pioneer Americans.

History stories and stories of early exploration in connection with the relief map or model of the state.

Continue talks upon government.

Study various means of transportation upon land and water, basing work upon the children's observations. Descriptions of traveling in the early days.

The making of graded roads and pavements. How the features of land and water affect position of roads and trails. How they have determined the position of the railroads.

Study of how the rocks, soil, features of the land and water, and the climate have determined what shall be the leading local industries. In what other parts of our country are similar conditions found.

The relative importance of stock raising in the home-district. Study by means of pictures and descriptions the important stock-raising regions of our country and find out reasons for its predominance in these localities.

Continuation of hand work and making of simple articles.

Biological

Continue study of the aquarium and of water insects. Make a study of the various water organisms, especially molluscs and crustaceans made use of by man. How and where they are obtained.

Continue observations upon birds, their value to us, their food, and manner of nesting. Make a study of familiar water birds.

Find out all about the uses to which the native plants of the neighborhood are put. Study plants with reference to the uses of various parts of the plant to itself, roots, leaves, etc.

From a study of the plants of the home and from pictures and descriptions discuss the effect upon them of heat, cold, dryness, moisture, rich and poor soil, of various parts of the earth.

Talks about and observations upon the struggle going on among the plants and animals around us; the food of animals, the food of plants, the need of sunlight.

The production of sugar from cane, maple trees and beets. If possible, grow sorghum, extract the juice, make molasses and sugar.

Agricultural

Study different kinds of soil as to which takes up most water and which holds it the longest. Experiment with sand, clay, loam, brick, solid rock.

Shape in which plants take their food. Is it all obtained from the soil? Wash some soil, evaporate water and note if there is any solid residue. Find out its nature.

Reasons for keeping soil loose about plants, effect of too much or too little moisture. Poor soil and how improved.

Experiments with plants to see if all need soil. Study of water plants.

Garden work and care of plants.

Study of what is most essential to plants, soil, warmth, sunlight, or moisture. How man changes these factors to suit needs of plants.

Physical

Experiments showing circulation of the air. Study of ventilation of the schoolroom. Origin of the winds.

The various kinds of clouds.

Begin collection of minerals of the neighborhood.

Carry out experiments in the preparation of lime, plaster, and plaster of paris. Study the minerals from which these substances are made.

Study the different minerals of a piece of granite, the uses of mica, feldspar and quartz.

Talks about gold and gold mining, and reduction of the ores. Study with aid of pictures and descriptions.

Origin of clay and sand. Base study upon a piece of crumbling granite. Uses of these substances.

Geographical

Study the paths of the explorers of the home region and how these were governed by the features of the land and water and by the climate. The occupations of the first settlers.

Model the features of the home upon a skeleton of rock to illustrate rocky elevations with little soil and valleys with deep soil.

Make a map of the relief model of the state.

Continue study of the relief model of the state, and basing conclusions upon local conditions, discuss the probable climate and productions. From knowledge of local climate or observations elsewhere discuss climate of mountains and plains, distribution of rainfall. Aid by use of pictures.

Continue study of food and other supplies produced in home district. Conditions in those countries from which the imported necessaries come.

Reasons for the location of the nearest trade centre.

Ancient and modern ideas as to the shape of the earth.

Extension of view area shown by climbing a hill or building, particularly if there are any large areas of land or water at hand.

Illustrate farther by use of a relief globe.

Locate upon the relief globe the various peoples previously read about, and the influence of the relief and bodies of water upon communication between them.

Study the work of running water in the vicinity; other influences wearing down the hills. Take samples of muddy water, let stand and determine what it contains.

Observe the conditions of waterfalls and rapids and their uses.

Observe formation of miniature deltas and upon what sort of slopes they are found.

Study the main rivers in the drainage basin of the home region from the relief model, note extent, character of streams and slopes about borders of basin. Aid with pictures.

Find illustrations as complete as possible in home district of formation of the main geographic features of the earth.

Using pictures of typical regions of the United States in connection with a study of the relief model, lead children to judge of the climate, productions and industries which should characterize them.

Nature-Study — Fifth Grade

INDUSTRIAL

Uses of the trees in the neighborhood. How lumbering in different parts of the United States is influenced by physical conditions; aid study with pictures.

The character of homes, fences, etc., where lumber cannot be obtained.

The decay of wood; manufacture of charcoal—the latter illustrated experimentally.

Talks upon coal and coal mining, using specimens and pictures. Descriptions of the different regions where coal is mined in the United States.

Primitive and modern methods of lighting, natural gas, manufacture of gas.

Hunting and trapping upon the Great Plains and in the Rocky Mountains.

Biological

Excursions to study effects of forests upon life. Effect upon its animal inhabitants of cutting down a grove or forest.

The distribution of trees in the home region.

Conclusions as to the absence of trees upon the Great Plains; the enemies of trees.

The distinction between the broad- and narrow-leaved trees (conifers). Those found in the home region. The most important areas of North America characterized by coniferous trees. Particular uses of coniferous trees.

Develop from studies in the home region an understanding of zones of vegetation upon mountain slopes and the causes which produce them.

The wild animals once found in the neighborhood and their distribution over the continent. The fur-bearing animals still found and their habitats. Necessity for the care and protection ot the animals and birds.

The protective forms and colorations of animals.

How water animals spread. Zones of life in the oceans.

A study of the winter birds.

The fishes sold in the market, where caught, character of people engaged in catching them.

The domestic animals of the native Americans.

The food-plants furnished us by the Indians.

Agricultural

Different ways in which plants spread and are propagated, seed, runners, bulbs, cuttings, budding and grafting.

Observations upon the effect of plant roots upon seamed and partly decayed rock. Determine soluble contents of a fresh rock as compared with a decayed one. Compare soils of deltas and hillsides in regard to luxuriance of vegetation. Effect of "alkali" in soil.

Note general effect of man's disturbing influence in beginning of erosion and carrying away of rich surface material. Effect of killing grass by stock.

Study of agriculture in all its aspects of influence upon man.

Physical

How the rainfall determines occupations in different parts of the country.

Readings and discussions of the great floods in the United States. Means of avoiding them, construction of reservoirs. Navigation upon streams in summer.

Examination of different kinds of lava, uses of various volcanic products. Readings and talks about the volcanic regions of the United States, Mexico and the West Indies. Probable reasons for volcanic action.

The keeping of a weather record, rain-gauge, temperature record.

Talks about the heavenly bodies and their movements.

Forces of nature working about us—heat, cold, water, frost, ice, gravity.

Geography and History — Fifth Grade

GENERAL SURVEY OF NORTH AMERICA

General study from the relief globe of the position of North America with reference to the other grand divisions of the earth.

Study from the relief model the position and character of the typical features of the continent.

Continue studies upon the erosion and deposition of rock material in the neighborhood, until by inference the meaning of the rugged or gentle slopes of the different mountain ranges, the canons, valleys, plains and great deltas can be explained.

Carry on observations upon the kinds of shore lines produced by the rising and sinking of the water in some shallow pond to illustrate the different kinds of shore lines of the continent.

With the aid of observations in the home region and pictures, form conclusions as to the general climatic conditions of the continent.

Reasons for such a marked difference in climate of the Atlantic and Pacific coasts in same latitude.

Discuss from observations the effect upon the air of a body of water in regard to both temperature and moisture. The effect of elevation upon temperature. The prevailing direction of the winds.

Use conclusions in forming correct notions of the climate of different parts of the continent, the situation of the moist regions, the deserts, the distribution of the forests, the Great Plains and prairies. From what has been learned of mining, locate the areas where that occupation is important.

Make a relief model of the continent and draw outline map of same.

Discussions and readings about the native inhabitants found in different parts, and how their ways of living, of traveling, and customs are related to the climate and physical features of their homes.

Stories of exploration and adventure. Conditions leading to the settlement of New England and the South Atlantic states. Character of the emigrants.

Spanish exploration, conquest of Mexico and Peru.

Voyages of discovery upon the Pacific.

Compare coast-lines of the opposite sides of the continent and their influence upon settlement.

Influence of the Appalachians upon the westward spread of the colonists. By what paths did they reach the Mississippi Valley. The importance of the chain of Great Lakes. The work of the French missionaries and explorers.

If the rugged Rocky Mountain system had occupied the position of the Appalachians, what would have been the effect upon the settlement of the continent? What effect would low mountains upon the Pacific border have had upon the climate and settlement of the continent.

Study the character of the streams upon the opposite sides of the continental divide. Mark out the great routes of the pioneer from the Atlantic to the Mississippi, and from this river to the Pacific coast. Describe the great obstacles presented in the Cordilleran region. Discuss in detail the natural routes of travel and trade.

Reasons for the rapid settlement of the Pacific Slope. Location of the chief cities of the country and reasons for the same based upon geographic conditions.

Stories of pioneer life and adventure.

Physical

Observations upon the relative ease with which the land and water surfaces of the earth are heated. Which gives off heat more rapidly? Discuss with reference to the temperature of the oceans and interior portions of the continents.

Winds and their effect upon the surface. Formation and movement of dunes. Wind storms of the great deserts.

The pressure of air, construction of barometer.

The different states of water, water pressure, observations upon the conditions which give rise to springs, artesian wells. Study of the pump, different kinds of pumps.

The boiling and mineral springs of volcanic regions. Discussions as to origin.

Mineral matter in solution in water, deposits in tea-kettles. Study of the Yellowstone Park from pictures and descriptions.

Salt, soda, and borax mining. Conditions surrounding the nitre fields of South America, and the salt and borax deposits of the North American deserts. Experiments in separation of soda and salt from one solution.

Beach sand, sandstone and quartzite, acids, alkalies and salts and how to distinguish them.

Coral and coral islands; limestone and marble.

Different methods for getting mineral substances buried in the earth, where most easily accessible. Base conclusions upon study of home region if possible. Distribution over the world of most important metalliferous deposits. Great coal fields.

Nature-Study — Sixth Grade

Industrial, Institutional

Discovery and invention—the harnessing of water, air, steam and electricity. Visit any accessible illustrations.

Talks about local, state and national governments.

Biological

Distribution of animals, causes of their migrations.

Distribution of plants, various agencies concerned in, influence of climatic changes.

Study of plants with reference to their improvement by cultivation, comparison of wild and cultivated rose, wild and cultivated apple, etc.

Study of tropical plants, comparison with any of their representatives in temperate climate open to examination.

Study of insects with especial reference to their harmful and beneficial influences. Tropical insects compared with their local representatives.

Study of mosses and lichens and other plants representative of Arctic and semi-Arctic conditions.

Plants and animals of desert regions, aid by pictures and descriptions and any accessible specimens.

Peculiarities of island life. Characteristic animals of Australia.

Life in the tropic seas; aid by use of specimens.

Agricultural

Importance of irrigation. Methods of. Aid by use of pictures.

Importance of the forest cover in preserving the summer water supply. Carry on practical studies on wooded and unprotected slopes.

Adaptation of plants and agricultural crops to different climatic zones.

Soils according to origin, residual, transported, wind soils.

Continue garden work.

Study the common grasses. The importance of grasses upon the vast plains of the earth's surface.

Geography and History — Sixth Grade

The World as a Whole

Study of the relief globe. Contrast nature of ocean floor with the land surface, deepest depressions and greatest elevations. Meaning of continental masses.

The peculiarities of different shore lines. Review in connection the shore lines produced in a pond by raising or lowering the water.

The prevailing winds of the earth, how the climate of different coasts is affected by them, contrast with interior regions.

Reasons for the irregularity of the isothermal lines.

The climatic conditions under which the great civilizations have developed. How extremes of climatic conditions affect people as shown by natives of Terra Del Fuego, the Esquimau, and many tropical peoples.

The boundaries of the tropics, nature of vegetation, animals, and occupations of the people.

The polar regions—tales of exploration and discovery. Recent explorations about south pole. Study of Iceland and Greenland, physical characteristics, glaciers, people and their occupations. Vegetation.

How the nature of the coast and the presence of deep or shallow water adjacent affects the industries, commerce and nature of the inhabitants.

The Phoenicians and Norsemen as representatives of maritime people of earlier times.

Character, extent and position of the great plains of the earth's surface. Occupation of early peoples who dwelt upon plains.

Reasons for absence of trees upon many plain-like areas, contrast with desert plains.

The causes which produce deserts; base conclusions upon a study of conditions in our own country. Distribution of deserts over the world, surface and life. Aid by use of pictures.

Contrast plains with deltas, distribution of delta plains. Soil of deltas.

Influence of deltas upon the development of civilization in the eastern hemisphere.

Reasons for the light rainfall of the Great Plains of the United States, contrast with those of South America.

The vast plains of northern Asia and their inhabitants.

Various kinds of mountains, illustrate.

Climate and products of mountains compared with adjacent lowlands in same latitude. Character and occupations of mountain people, illustrate in case of Switzerland.

Distribution of the highlands and plateaus of the globe. The highlands of Mexico and South America and their primitive people. Thibet and its people.

Connection between mountains and mining. From a study of our own country, say what minerals are generally found in mountainous regions and what in lowlands and plains. Give reasons.

Influence of mountain barriers upon trade and communication.

The primitive peoples of different parts of the earth.

Geography of current events given importance throughout the year.

Nature-Study — Seventh Grade

INDUSTRIAL

Study of industrial operations in different parts of the world as related to the character of the people and their physical surroundings.

BIOLOGICAL

Economic importance of birds based upon observations of pupils.

Adaptation of birds to different conditions, ostrich, wingless birds, wading birds.

Adaptation of animals to different environments, camel, mole, seal. Habits and relationship of the bat.

Observations upon the animals of Africa and Asia as far as they are represented in accessible collections. Supplement with pictures of their native habitats.

Study of several water plants including the lily; the lotus in ancient Egypt.

Study of minute water organisms with the microscope, care of the water-supply, purification of water.

The growing and care of grapes, making of raisins and wine. The extent of this industry in southern Europe.

PHYSICAL

Experiments and observations upon the phenomena of evaporation and condensation, to illustrate the moisture in the air, formation of clouds and rain.

Solution, saturation, and crystallization illustrated by some salts such as hyposulphite of soda and common salt. How salt is prepared from sea-water, from salt wells. The important salt deposits of the world in Poland

and America. Illustrate how a bed of salt may be formed from sea water in some lagoon.

Continue collection of the rocks and minerals of the neighborhood, and gain a familiarity with their physical properties and uses.

Sulphur, its occurrence in various volcanic regions; its preparation upon the slopes of Mt. Etna in Sicily.

Descriptions of the mining of gold and diamonds in South Africa. The tin mines of Cornwall.

Geography — Seventh Grade

EASTERN HEMISPHERE WITH ESPECIAL REFERENCE TO EUROPE

A general survey of the physical features.

Climatic conditions of Eurasia compared with North America.

The importance of the Mediterranean Sea.

The pre-historic inhabitants of Europe, cave and lake dwellers.

Ragozin's Earliest People. Queber's Stories of the Greeks and Story of Rome.

The geography of the world as known to the ancients.

The farthest points reached by the ancient navigators, their ideas as to the shape and size of the world.

The spread of Christianity and Mohammedanism. Study with reference to the character of the peoples and the physical geography of the countries concerned.

The Crusades and the age of Chivalry.

The story of the Norsemen; the character of their country.

The various peoples concerned in the founding of the English race.

The Moors and their civilization. Spain in the fifteenth century and her explorations by sea.

The importance of the chief mountain ranges of Europe and the influence which they have exerted upon the development of its people.

The importance of the irregular shores of the northern Mediterranean and eastern Atlantic in affecting the development of their inhabitants.

Reasons for the slower development of the people of the interior and northeastern portions of Europe.

Causes of the early development of manufacturing in England.

Situation and physical surroundings of the leading cities of Europe.

Constantinople and the Dardanelles.

Situation of Russia with reference to outlets to the sea. Conditions which have made it possible for her to spread eastward and southward in Asia.

Influence of the Himalaya Mountains and Plateau of Thibet upon the history of Asia.

Causes leading to the marked differentiation of the Chinese and Japanese.

Effect of slow sinking of coast of northwestern Europe. Features and occupations of people of Holland.

The forests of northern Europe and their wild animals.

Geography of current events throughout the year.

Nature-Study — Eighth Grade

INDUSTRIAL

Development of industries in connection with the settlement and growth of communities.

Taking different sections of the country, study their characteristic industries as related to climate, physical features, soil, and means of communication.

BIOLOGICAL

Study from observation and illustrations specimens of the main groups of animals. Detailed study of how animals have become adapted to the various conditions of land and water existence.

Observations upon the most important plant groups.

Food of plants contrasted with that of animals.

Study of a few flowerless plants, mushrooms and fungi.

Lowly organisms source of disease. How to guard against.

Influence of man in distribution of plants and animals.

Characteristic plants of the different life zones of North America. Life-zones of the high mountains.

Various problems of forestry, growing, cutting and preservation from fire and disease of forest trees. Characteristics of forests of different portions of the United States.

PHYSICAL

Different forms of matter. Experiments in changing matter from one form into another.

The study of chemical reactions involved in various common phenomena.

Air, heat, light, electricity as concerned in various problems and activities of life. All work, both observational and experimental to be closely connected with actual problems confronting the pupils or experiences which they may undergo.

Geography and History — Eighth Grade

More thorough study than previously attempted of the processes at work building up and tearing down the features of the earth's surface. Illustrate as far as possible by observations, experiments. Supplement by reading and use of pictures.

Review main facts of Colonial life and development, explorations and settlement of different portions of the North American continent.

Connected study of the history of the United States from the Revolution down to the present. Carry on this work with relief models and maps constantly at hand and seek at every step to bring out causes and relations.

Bring out in connection with every event in the internal relations of the people, in the expansion of the territory of the United States and in the development of its industries the geographic factors concerned. The most important of these factors are the original inhabitants, character of the new comers, climate, soil, natural products of the soil and rocks, presence of mountain barriers and deserts, mountain passes, lakes, navigable streams, water power, etc.

Show the relation of the expanding nation to the peoples to the north and south and the geographic reasons for the position of the final boundaries established.

Geography of current events throughout the year.

THE VALUE OF KNOWING NAMES OF NATURAL OBJECTS

A Symposium by many Writers

[EDITORIAL NOTE.—The question whether there is value in knowing the names of natural objects is easily and satisfactorily answered so far as very common objects are concerned, but it must be obvious to all science and nature-study teachers that as our list of names tends to become extensive it is a question whether memorizing names is valuable. In order to draw out definite statements of opinions from naturalists a circular letter was sent last July requesting brief discussions of the question, "Is it worth while that pupils should learn the names of natural objects?" The answers, in the order received, are given below.]

In answer to the question "Is there value in knowing the names of common natural objects," I would say that there is a decided value, provided it is not pressed too far. It is a source of satisfaction and hence of additional interest to be able to name things. The only objection that could be made to this kind of information, so far as I can discover, is that the name may become the end of the investigation rather than its beginning. I like to have my students think of names as necessary appendages to plants, just as names are to individuals whom one meets and wants to know. No one would think that an introduction to an individual, which gives the name, means an acquaintance with the individual. The name, therefore, as I look at it, is the preliminary stage to an acquaintance.

JOHN M. COULTER.

UNIVERSITY OF CHICAGO.

There is a value in mere names. As naturalists we might dispense with names and books, but as educators we cannot. Culture and education come chiefly through names, books and the literary concomitants of the subject. I have known many good naturalists—wood-choppers, basket-makers, hunters, trappers, fishermen, farmers—with knowledge of things, but evidently not educated by them. I have known many skilled bird-stuffers, who were far from being good ornithologists. Don't lay too much stress on natural objects alone. We want names, books and other literary and scientific accessories.

EDWARD F. BIGELOW.

STAMFORD, CONN.

The question "Is there any value in knowing the names of common natural objects?" reminds me forcibly of the story of the German botanist who collected quantities of material of which he did not know the name, but which a brief microscopical examination showed him would yield rich histological results. Over it he worked for a long time—years, in fact—and each day with increasing enthusiasm. His first diagnosis had only touched the outside of its scientific wealth and value. Finally he was ready to publish. But he had used up all the material and had no idea of the name of the plant which he had been studying!

The names of the common objects about us are of the first importance; for after all, with things as with persons a knowledge of the name is an invariable preliminary to acquaintance and affection. Imagine saying to a child: "Do not bother with the names of your schoolmates, their real character is of much more importance." It is of use, but to know the name does not mean to know nothing else. The name is a key which unlocks many doors—books, for example—and the knowledge of other people. Keys are essential just because they unlock things, not because they are keys.

L. L. W. Wilson.

Philadelphia Normal School.

The names of common natural objects should be known. It is not of much importance to know the scientific name, really of no importance at all to the layman, unless the scientific names become so common that they become the common names. Nor is it seriously important whether the common name used be the one most widely known. If the object is known locally by some particular name, which is not the common name most widely used, it is best in that section of the country to use that local name. Some name, however, should be known and used. The more distinctive and general the name be the better. A widely used name, however, is of little value in a place where there is a local name that is well known and where the more widely known name is unfamiliar. It is, of course, highly desirable that a uniformity in common names be attained, but this under the present conditions seems practically unattainable. The confusion is far worse than that experienced with scientific binomials, and the machinery to remedy the defect far less adequate; a gentle pressure toward uniformity is commendable but ruthlessly to attempt to force uni-

formity of usage would be to retard the growth of popular knowledge of common things.

It is useless to discuss the necessity of having *a name* for objects. The proposition is axiomatic. An object cannot be referred to definitely without a name, and when it cannot be referred to it cannot be discussed, and its use and injuries caused by it cannot be attributed to the proper source. Without a name it is nothing in its community.

F. L. STEVENS.

NORTH CAROLINA COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

In regard to the question "Is there a value in knowing the names of common natural objects," I should say emphatically yes. I think it is far better to teach children something of the things about them than a good many facts about India, China and Japan. I believe we all should know all we can about the common things about us, and be able to observe and to see some of the things we look at, and to understand something of what we see, and that by so understanding these things our life will be broader and more interesting not only to ourselves but to others. There is far too much ignorance concerning common things.

H. D. HEMENWAY.

HARTFORD SCHOOL OF HORTICULTURE.

My answer to the question whether there is value in giving the names of common objects, is taken from my "Nature-Study Idea": "Would you tell the child the names of the things? Certainly, the same as I would tell him the name of a new boy or girl. But I should not stop with the name. Nature-study does not ask finally 'What is the thing?' but 'How does the thing live?' or 'What does it do?' or 'How does it get here?' or 'What can I do with it?' The name is only a part of the language that enables us to talk about the thing. Tell the name at the outset and have the matter done with. Then go on to vital questions."

L. H. BAILEY.

CORNELL UNIVERSITY.

The recognized *common names* of natural objects are of great value to young people as they afford a means of communicating many facts of interest as, for example, in describing what they saw on a journey or a walk. The Latin names are out of place in

nature-study, because that phase of study of natural things is untechnical. When the child is *introduced* to a new flower, bird, or fish, *he wishes to know its name.* After that he feels *acquainted.*

WINFIELD S. HALL.

NORTHWESTERN UNIVERSITY.

Is there value in knowing the names of common natural objects? On this question I have already published my views in my book "Education Through Nature." I have found no reason to change my opinion since. A name is a label by which we identify bundles of facts, conveniences of which the teacher at least cannot afford to be ignorant. The president of a Chicago medical school said once in addressing his graduating class: "If you ever encounter a disease which you are unable to identify, by all means give it a name." This certainly expresses a shrewd man's opinion of human nature. Many patients feel a sense of relief as soon as their ailment has received a name. So we never feel that we have been properly introduced to a person till we have been made acquainted with his name. Indeed we are often made to assume that we know a man when his name has been presented. Whether the name is Latin or Greek, Italian or German matters little. In nature-study we cannot fail to note the same tendency in pupils—a desire to know the name. Any "old thing" of a name seems to satisfy. Too often we are satisfied with the mere name; and if care is not taken, nature-study is apt to degenerate into a mere learning of names. If this tendency is properly counteracted, I consider it very desirable to teach pupils how to find the names of objects by proper use of reference-books—the most convenient often being the unabridged dictionary and encyclopedias.

J. P. MUNSON.

STATE NORMAL SCHOOL,
ELLENSBURG, WASH.

In regard to your question, "Is there value in knowing the names of common objects," it seems to me there can be but one answer, which is very obvious. We should know the name of things for the same reason we like to know the names of people with whom we have to deal. There is nothing in a name that is to be worshipped, but it is a very convenient thing to have at

hand. One of the first things I teach therefore by the shortest possible method, unless for some special reason it is withheld, is the name of the object.

WILBUR S. JACKMAN.
UNIVERSITY OF CHICAGO.

To my mind this is no more a question than, "Is there any value in nature-study?" How can you know nature without knowing names? But it must be borne in mind that the knowing of names is a means, not an end.

Suppose you go to a new school or a new town. One of the first things you do is to learn the names of the people. You cannot have very much of usefulness or interest in that town until you know the people by name. You cannot talk concerning the town and its people.

You cannot communicate any great number of ideas without words and you cannot teach much nature-study without names.

Moreover it is natural for the young child to learn the names of things. That is the first step in the education of the infant. Nouns are always the first parts of speech learned. Teaching the names of things is the first nature-study to be taken up. Later the names will be used as pegs on which to hang facts about things.

I have found by personal experience that one of the most successful ways to interest boys and girls in nature is to teach them the names of natural objects such as flowers, birds, minerals, etc.

A. J. GROUT.

BOYS' HIGH SCHOOL,
BROOKLYN, N. Y.

AN EDUCATIONAL BEE-HIVE[1]

BY EDWARD F. BIGELOW

Stamford, Connecticut

In a booklet published by The A. I. Root Company, Medina, Ohio, and distributed by that corporation free of charge to those who ask for it, I have explained why a bee-hive seems to be needed for educational purposes, a hive that shall be worthy of the interest sure to be aroused by the instructive and often unknown or unappreciated habits of the honey-bee.

[1] [The hive described in this paper has been named by the manufacturers after the inventor, who writes this article.—Managing Editor.]

Complete hive with covers removed. Main hive in front consists of base, observation chamber, super with four sections, and two "travelling hives" at top. In the rear is the flying cage.

In that booklet I have briefly set forth the main points of this special hive. What I have there stated regarding its advantages I trust will be made clearer by the accompanying illustrations, their subjoined legends, and this additional description.

The structure is not so much a hive, which is a mere home for the honey-bee; but rather a complete, elaborate, handsome apiarian apparatus or laboratory supplied with every facility for observation, instruction and experiment. I have long been of the belief that full justice—if not more than justice—has been done to cheap, home-made, simple contrivances for keeping and observing these most fascinating and useful members of the insect world. That it is an expensive hive I admit. That I have purposely made it so, I also admit; and I strongly advise that it be ordered only in oak or in ash, the wood to be as highly polished as possible. No patent has been put upon the hive and the purchaser pays only for the material and the labor. I have made such arrangements with the company which manufactures and places it in the market, that I am convinced they are doing it without any pecuniary profit, trusting for that to come from an increasing interest which this hive will excite in bees, and therefore an increase in orders for the ordinary apiarian goods.

The Complete Hive:—As set up in my laboratory, there are placed in the entire hive ten frames in base, ten in observation chamber, three in "travelling hives" (at top) and twelve in flying cage—thus a total of thirty-five. The flying cage holds twenty frames, but it is preferable to put in not over twelve—two sets of three each on each support. It would be even better, perhaps, to put fewer frames in the flying cage when it is used in connection with the rest of the hive.

It is also intended that usually only one frame shall be put in each half of the two observation chambers. This arrangement brings under full observation the outsides (half of whole frame) as follows —two in base, two in observation chamber, four in travelling hives, four in flying cage. There will also be seen fairly well the inside surfaces of the four frames (one of each set) nearest the center of the flying cage. Thus there are visible sixteen sides of frames or an equivalent in sides of an entire eight-frame ordinary hive. But in actual practice, this Educational Hive gives an equivalent of two eight-frame hives, fully under observation, because as the two sides of any one frame are usually about the same, a full observation of an ordinary hive would show eight different combs, or stages of progress in the work, while this Educational Hive shows sixteen different frames under observation at once. And as has been previously explained, if it is desired to crowd the hive to fairly full capacity, there would be a storage or "base of supplies" in nineteen additional

frames (not visible), a total of thirty-five. Thus it will be readily seen that the hive is of enormous capacity for observation or work, and admits of a great variety of combinations and arrangements, to meet the needs of experiment, or to suit the fancy of the operator.

The entire structure full of frames would hold forty-three, of which twelve sides would be easily under observation at one time. (When the flying cage is filled with frames, of course no interior surfaces

Side view of the Bigelow Educational Hive, showing storage of honey in outside frame at base, three rows of developing queen-cells in observation chamber, four full sections of honey in super, and brood, honey and bees working in "travelling hive" at top

are visible. When fewer than twelve frames are put in, if separated, more than four interiors may be seen.) This is in addition to eight outside sections in super, and gives full facilities for exhibition of the stages of comb making, the storage of honey, the cell structures, the queen, the drone and the worker brood, and a variety of novel experiments.

There is ample room under, above, and between the two tiers of frames in the flying cage for any form or for several forms of base feeders such as the Page, or the Miller.

Between the one frame and the two frame hives at the top of the main division are two glass-jar feeders, in which the bees are sucking downwards (feeding from underside) the syrup. In all others they are sucking it upwards (feeding from top). The hive as a whole is designed to be set up at some distance from the window or other exit through the wall of a building, for temporary exhibition at a fair, a museum or for special visitors' day at a school (when it is not convenient to take a large number of visitors to the regular location of the hive in another part of the building).

In devising this form, I have had in mind also an exhibition in the center of large stores. To the store keeper this would be a novel and excellent advertisement to attract people to the store, to the apiarist a source of income for the placing and the renting of the hive and contents, and to the advancement of bee-keeping, because producing an increased interest on the part of the public.

Body of Hive:—This holds ten regular frames, a "base of supplies," a brood chamber and force of bees. One side of each of the two outside frames is visible. It is recommended that stored honey in full (as in the illustration) be shown in this.

Observation Chamber:—Designed especially to show processes of queen rearing. This chamber is of extra depth, and the glass (as in body and super) are readily removable. Frames may be *taken out or put in at the side.* These chambers (two made by an especially deep padded division board) are automatically filled or emptied (as are the one frame and two frame "travelling hives" above the super). This is done by a system of slides—a long slide covering plain slot and a Porter bee-escape slot in base of chamber to be filled, and a long plain slot corresponding in length to both above it, in the base below the operating chamber.

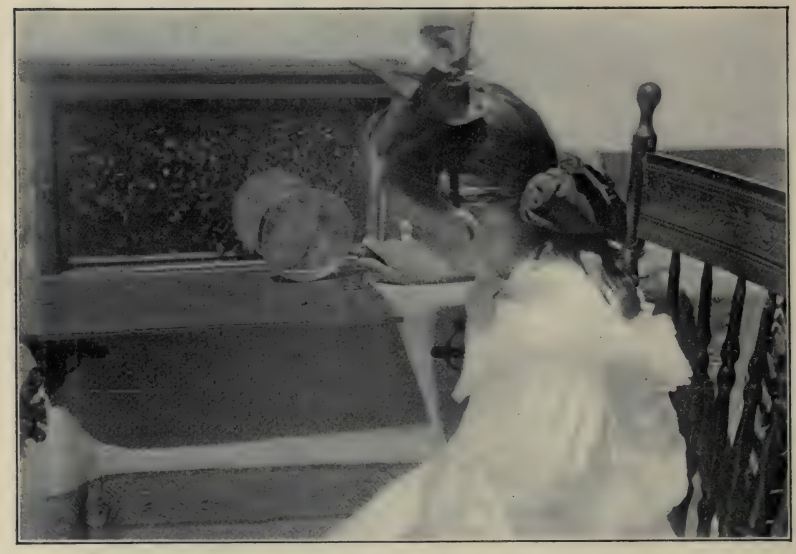
When the slide in the base of the operating chamber is out, bees go in or out. When the slide is half way in, bees go out only; and by pushing the slide fully in, bees go neither in nor out. Thus one or more brood-frames in either chamber may be isolated or emptied of bees by manipulating this slide. The same principle is applied to the bases of the one-frame and the two-frame travelling hives and to the magnifying feeder.

Super:—This has thirty-two full sections, each four by five inches, the entire one side of eight being plainly visible.

One-Frame and Two-Frame Travelling Hives:—These have the automatic filling, emptying and isolating devices by a system of two slots, two slides and bee-escape, as explained under the head of obser-

Demonstration of the gentleness of Italian bees. A class of nature-study teachers, with Dr. E F. Bigelow, at the apiary of the Root Co , Medina, O. Thirty-two frames removed from four hives. Bees not stupified by smoke.

vation chamber. They are fastened by hooks to the super cover, and are easily isolated or carried to any distance. I have carried a one-frame with the queen, and about five thousand workers and one hundred drones, to the four normal schools in the State of Michigan. I spent a week at three of these schools and a day at the fourth. When the frame was not in use before public audiences, the bees went out to view the country and to gather material. The hive was placed on the lawn, or by an open window in schoolroom or in my room at the hotel, and the sliding wire net before the entrance at the lower part of one end was drawn out. When I arrived home the entire swarm was in better condition than it was when I started.



A large reading glass, preferably one five inches in diameter, makes more interesting and easier to observe all the activities of the hive.

Magnifying Feeder:—This is regarded by many persons as the most original, novel and interesting part of the hive. It is fully described in the booklet previously mentioned.

Flying Cage:—Three sides of this are of glass, the fourth being of wire netting. Ordinary frames may be placed in it, but it is made of special depth so that rustic sticks may be placed on supports, so that the bees may build natural combs, and not the shallow, square-cornered combs of the artificial frames. When thus used separately with the exit open into the free air (not into the main portion of the hive) it becomes an observation box hive, or the interior of the original bee tree, with combs on any sort of sticks, and of any length

that the bees see fit to build. By having a hole in the center of the cover board, a super or any other apparatus may be placed above it. But for this purpose the writer prefers the original straw hive, and thus in one complete structure would be shown the interior of the original bee tree, the first steps in hive making (the straw hive above it) and at the left a complete modern hive with most improved experimental apparatus and accessories.

The use of a hand-lens five inches in diameter makes any part of the hive, or of any structure, or the movements of the bees more readily and effectively seen and is strongly advised.

I believe this hive to be worthy of the subject. It is a great and unusual convenience. Its facilities are unlimited, and it will soon become a joy to the purchaser, especially if he will use it for the study of the *Apis mellifica*.

My best wish to you, my reader, is that you may obtain as much instruction and enjoyment in the use of this hive as I have found. I own three complete with about forty-five sides of frames under constant observation.

If you can't get the whole, start with the one-frame travelling hive. Watch the two sides, and be happy—and dream of getting more hives and more happiness.

DO BIRDS EAT BUTTERFLIES

BY T. D. A. COCKERELL

Lecturer in the University of Colorado

One of the last papers written by Dr. A. S. Packard was on the origin of the markings of organisms, with criticisms of the commonly-held theories regarding mimicry in butterflies.[1] I do not propose to discuss this essay in detail, but merely to point out how well it exposes our ignorance of common things—things which any intelligent child might observe. The whole of it (58 pages) is interesting and suggestive, and whatever one may believe as to the validity of Dr. Packard's deductions, it is well worth reading.

It is well known that certain butterflies exhibit a wonderful "cryptic coloration"—that is to say, they resemble their surroundings to such an extent that they can hardly be seen when at

[1] The Origin of the Markings of Organisms (Pœcilogenesis) Due to the Physical rather than the Biological Environment; with criticisms of the Bates-Muller Hypotheses. Proc. Amer. Philosophical Society. Vol. 43, No. 178. Read Dec. 2, 1904.

rest. The Asiatic leaf-butterfly (Kallima) is quite familiar in museums, and from pictures in nature books; but our own hedgerows provide sufficiently good example among the comma-butterflies (Grapta) and others. It has further been observed that in numerous instances different species of butterflies resemble one another; and when this is so, usually one of the pair is apparently protected from the attacks of birds by its nauseous taste. It is not necessary to go into further details about protective coloration and mimicry—there are plenty of available discussions of these matters—but we may say at once that those who have paid most attention to these phenomena believe that they result from the action of natural selection preserving those individual butterflies which most resemble their surroundings, or most closely resemble species which are recognized as inedible. By a succession of such choices, extending over a long period, the butterfly-type is supposed to have been gradually altered, until the results that we see today were produced. Various modifications of the theory thus briefly outlined have been proposed, but all depend in the main upon the assumption that butterflies are habitually eaten by birds—so much so as to make the avoidance of such a catastrophe one of the chief cares, as it were, of butterfly existence.

Now comes Dr. Packard and asks, *are butterflies eaten by birds?* It is admitted, of course, that birds do *sometimes* eat butterflies; but do they do so habitually? If butterflies are in no more danger from birds, the world over, than men are from lions and tigers, let us say, then do not these theories of mimicry and the like fall to the ground?

Dr. Packard says that in July, 1901, for the first time in his life, having for over forty years observed and collected insects, he actually saw a bird chase a butterfly. Dr. J. B. Smith, the well-known entomologist of New Jersey, affirms that only once has he seen a bird chase a butterfly. Dr. W. M. Wheeler, of the American Museum of Natural History in New York, has never seen birds pursuing butterflies. Dr. Needham, of Illinois, a most expert observer, has never seen a bird chase and eat a butterfly, nor have any of his students seen it. Dr. S. H. Scudder, author of the greatest work on American butterflies, affirms that only once in New England has he seen proof that birds catch butterflies.

There is some evidence on the other side. Thus Prof. J. Kennel, of Dorpat, watched a pair of warblers feed their five young

all day long with butterflies. One of the species caught, however, was Vanessa urticae (the tortoise-shell butterfly), which at rest exhibits decidedly "cryptic" colors. Taking the whole of the facts as presented, we are forced to admit that the opinion that birds habitually eat butterflies to such an extent as to produce the results that current hypotheses demand, is much more a "pious opinion" than a statement of known facts.

However, when we go again over the evidence, with a more critical eye, there is one thing that strikes us at once. Nearly all of it has been gleaned accidentally, at haphazard, as it were; or (in a minority of instances) is the result of careful observation continued only for a very short time. Birds and butterflies are everywhere; but who has really gone at this problem seriously? Did the reader ever see a hawk catch a bird or a mouse? Did he ever see a butterfly hatch from the chrysalis in the wild state?—there are many things which occur constantly all around us, to our certain knowledge, but we do not see them. Naturalists are not much better than others, for they are usually on the lookout for their particular "game," to the exclusion of everything else. Who, in these busy days, will sit still somewhere for a couple of hours, and just see what *happens?* Probably the most important testimony, so far as it goes, is that of Mr. S. D. Judd, of the Department of Agriculture, who has spent so much time examining the stomach-contents of birds. He says: "I do not know of a kind that feeds upon butterflies during any month of the year to the extent of one-tenth of one per cent. of its food." It may be urged, against this, that butterflies are hard to recognize in birds' stomachs (the wings having usually been discarded), and also, that a small per cent. of the food of a common bird means a great many butterflies.

I believe that the argument that birds are not often seen to *chase* butterflies is a fallacious one. The flight of butterflies usually protects them from capture on the wing, and the very fact of the development of so many colors which are "cryptic" when the insect is *at rest,* points to the time of the greatest danger. Who can find the butterflies on a dull day? Here is an exercise for sharp eyes, and if followed up by taking photographs of the resting insects among the foliage, would be both exciting and profitable to science.

Probably the best facts for or against the theories discussed are

to be obtained by watching birds feed their young, as Professor Kennel did. What children will volunteer to watch a bluebird's nest or a sparrow's for a week, and note every butterfly brought there by the old birds?

For myself, I believe that the selection theories are correct. But whether they are or not, we want the facts, and plenty of them. *What we need so much in biology is an adequate series of little observations, accurately made.* Those little things which are "hardly worth noting" become the very basis of broad generalizations. We may not all devise new theories, but everyone who has a good mind and is honest may make new observations.

What is worth noting? What is of interest? That depends so much on the way we look at it. Perhaps you have read Hammerton's directions for conversing about a rat, in "The Intellectual Life"? We may borrow the thought, but change the instance. Here is a piece of information, which I promise you is new:—When in Roswell, New Mexico, a few years ago, I bred a fly, Frontina frenchii, from Anosia plexippus. A trifling and uninteresting piece of information, you say; everyone knows about the parasites of Lepidoptera. But let me try again:—The milkweed butterfly (Anosia plexippus) is one of the protected forms, generally understood to be inedible. Scudder at first believed that it was also protected from parasites in the larva and pupa state, and Wallace cited this opinion in his "Darwinism." Since then, however, it has been found that it has some parasites, and four species have been recorded. One of them was named Frontina archippivora, from archippus, a name by which the butterfly used to be known. When at Roswell, New Mexico, a few years ago, I was so fortunate as to breed from A. plexippus an additional parasite, closely allied to the one just mentioned. It was Frontina frenchii, of Williston, and was kindly determined for me by Mr. Coquillett of the National Museum.

SCHOOL-GARDENS IN PHILADELPHIA[1]

Extracts from 24th Annual Report of Public Education Association of Philadelphia

No subject ever taken up by the Association has met with such popular interest and support as has the school-garden movement,

[1] Attention of those interested is called to the story of the Gardens by their Supervisor, in the April *Booklover's Magazine.*

now entering on its second season. The part of the Association in it has been that of the friend only; for from the beginning the Board of Public Education, and especially Mr. H. H. Hubbert, Chairman of the Committee under whose charge it came, listened to the plea for this work to be undertaken. In Councils it has found warm friends and none more so than Mr. George McCurdy, the President of Common Council. The history of school gardens in Philadelphia already well shows that it *matters not so much whether the ideas of one or another group of individuals are carried out as that the work shall be sanctioned and supported by the people.* It is because school-gardens have from the start been conducted as a legitimate part of free public education in Philadelphia that the pride and interest in them have been so widespread and immediate. There is no interest more potent than that bred of ownership, and there is no question but that the response of the educational and financial authorities of the city to the movement for school-gardens in Philadelphia, which has come in an astonishingly short time, is due to their pride that this work, which was immediately successful, is being conducted, not privately, but as a *part of the public school system.* It appears that the public is really interested in a movement only when public money is invested in it and the prestige of the city at stake. An amusing incident at the West Philadelphia Garden this year shows that even the children appreciate the assumption of this work by the city. "Who's givin' us this garden?" said a little girl one day. "The Board of Education," was the Supervisor's reply. "H'm! Gettin' wiser every day," was the comment.

One of the respects in which we feel most definitely the wisdom of the school-garden experiment is in its reaction upon the schools. The introduction of industrial education into the schools is a subject that is being much discussed in America to-day. The public, generally, is demanding it, and the subject is under discussion in one of our committees, but some experienced teachers of manual training, notably the principal of our Central Manual Training High School, Mr. William L. Sayre, do not believe such a course wise. They caution us against overtaxing the mental and bodily strength of children, believing also that the educational value of manual training is best conserved by restricting it to the high school period. School gardening is a very practical form of industrial training, and to its introduction no educator has given

aught but encouragement. We believe the effect of the gardens upon the schools will be seen next fall in the Taggart School, for the 250 children of the 5th and Porter Streets School-Garden practically all come from that one school.

On March 8, 1904, our Association petitioned the Board of Public Education to establish two school gardens, and the Councils to provide the money for them. An appropriation for the purpose was finally passed on May 5, and on May 24 and 28 respectively, two gardens were planted, with radishes, beans, lettuce, and other vegetables, arranged around a central plot of flowers.

The first garden was in the heart of the most crowded foreign district of the city, at Weccacoe Square, 5th and Catherine Streets, the property of the city. The second garden was at 56th and Lansdowne Avenue, on private property which was lent for the purpose by Mr. John Wanamaker.

At each garden were 250 individual plots $4\frac{1}{2} \times 11\frac{1}{2}$ feet, each of which was assigned to one of the boys or girls of the upper grammar grades, who applied by hundreds, from the schools near the gardens. In addition to the individual plots, there were eighteen general plots at each garden, where were grown grains for the observation and instruction of all. About one-third of the space at each garden was devoted to a playground. These playgrounds proved of benefit chiefly to boy and girls of about twelve years of age, for whom the street is the only alternative—since the thirty or more playgrounds opened in the school-yards each summer, by the Board of Public Education, are used almost beyond their capacity by the *young* children of the neighborhood. The shaded playgrounds served to hold the children during the hot hours of the summer between the morning weeding, picking, and planting, and the evening watering.

Between May 15th and June 30th, and again from September 8th to October 8th, the little farmers were at school, when the hours from four to six were the only times that the children could work in the gardens. For the teachers, however, all the hours were fully occupied; in the spring they had to prepare lessons, seeds, roll-books, etc., and in the fall to explain the methods and purpose of the work to the numerous eager visitors, and to teach the classes brought by the teachers of neighboring schools for observation. In the early hours they also prepared the nature-

study materials for the schools. Nature-study lessons were given to the visiting classes by the garden teachers, and materials for nature-study were grown and sent to schools when requested. On Saturdays, both teachers and pupils were occupied at the gardens all day. By the 535 individual plots, farmed in the course of the summer by 775 children, by the playgrounds—open to the neighborhood, by the 48 visiting classes from schools, and the nature-study materials sent to 285 schools, altogether it will be seen that several thousand children benefited by the gardens and the attached playgrounds.

The average daily attendance in the Weccacoe School-garden was 150, in the playground 100. The total number actually working the 250 individual plots in the course of this one summer, at this one garden of about a half acre, was 400. The number of children who began at the beginning and staid to the end was 71, in spite of the fact that others were waiting to take the places of any that became irregular or careless. Some waited in vain all summer. The estimate of produce per plot from this hard clay ground, where even a second dressing and ploughing had brought to light only a second crop of bricks, was 225 radishes, 40 beets, one peck of string beans, 25 heads of lettuce, 100 small turnips, two small heads of cabbage, and peas which, however, failed because eaten by the sparrows. The number of schools supplied with nature-study materials from this garden was twenty-two, of classes visiting the garden, thirty-seven.

For this year, every one of last year's 400 children, and as many more, again have begged for plots, but the Square is not again available. The downtown garden is located this year at Fifth and Porter Streets, opposite the Taggart School, whose teachers are already asking for class plots, and are giving such coöperation to the garden work that the educational side of the work,—which was the reason for its incorporation in the school system,—will probably find a far greater development than was possible during the first year. At date of writing, the attendance at this garden, purely voluntary, ranges from eighty per cent. to ninety-five per cent. per week, showing how the children regard the " work."

At 56th and Lansdowne Avenue there were 285 individual and ten general plots, farmed in the course of the five months by a total of 375 children. Average attendance at the playground all day was forty, in the garden 1000. One hundred and ninety-one

of the children that began work at the beginning of the season were still there at the end. The produce per lot is here estimated at 225 radishes, 1 pint peas, 115 tomatoes, 1½ pecks lima beans, 10 heads of lettuce, and 10 carrots. Because of the vicinity of this garden to the country, in spare moments wild flowers could be collected for the schools, and the number of schools supplied with materials for nature study, language, and drawing materials from this one garden reached the large total of 263. Eleven classes from neighboring schools visited the gardens for lessons in nature-study.

This garden is open again this summer, until October 15, and it is hoped that a closer connection with the schools may be added to the features of its success last year. Already kindergarten classes have planted class plots. Visitors are welcome at both gardens, and the teachers say that no critic ever remains a critic after once seeing the children at work.

Registered visitors at the two gardens numbered 486. Many more came and did not register. Many were teachers; many came from other cities. The public interest in the work is great and is growing. How fully it appeals to the children is indicated by the numbers from whom the choice for plots was made, in order of application: 544 boys and 458 girls made written applications for the 535 plots, and every one of them and many more have applied for this summer. Donations to the amount of $91.09 were made to the Weccacoe School Garden by fourteen persons, members of our Association and others, for extra plowing, for a tent against the hot sun, and for games for the playgrounds. The newspapers gave great assistance, frequently publishing illustrated news articles.

The unqualified success of the gardens and the unquestioned benefits to children of garden work have spread the popularity of the movement until now a garden is asked for in nearly every ward in the city. Although the state of the city's finances may prevent so large an extension, from two to forty-two next year, at least it is hoped that the number of those maintained by the city may be increased from two to six.

Extension of the movement has led to a discussion of the training of teachers for garden work and the suggestion has been made that a course in the teaching of gardening might be introduced next winter into the Normal School, as has already been

done in normal schools in Massachusetts, Illinois, and Missouri. Without trained teachers, gardens can have little educational value.

The work done by the gardens in supplying nature materials to the schools should also be extended. The schools have found in the gardens a supply for language, drawing, and nature lessons. From the time the schools opened, on September 8, until October 8, when the gardens closed, the *gardens were visited almost daily by one or more kindergarten or grade classes* from the various public schools near them. Each class filed through the garden, and received a lesson from one of the garden teachers on the vegetables grown. A part of one such lesson overheard was a comparison of one vegetable of which the root is eaten, with another in which the leaves are eaten, and still another in which the fruit, or the seed is used. In addition to those visits to the gardens, a large number of schools, from all over the city indeed, sent requests to the gardens for supplies of specimen plants, leaves, or flowers for use at school, to be drawn, studied, and written about.

This use of the gardens as a supply depot has led to the suggestion that the city should continue throughout the year this excellent method of assistance to its regular school teachers, in order to make the work of the schools more alive. By retaining the garden teachers regularly through all but the coldest months, to supply nature materials to the schools, schools could be supplied throughout the fall and spring, and the balance of the time in winter be used by the teachers for the necessary study and vacation.

A further suggestion for the extension of the playgrounds that were run in connection with the gardens is that *every school-yard in the city should be open* to the free play of children *during all the daylight hours.* More games are needed for the playgrounds, and our readers are asked to see if they have not some unused basket-ball, tennis, croquet, or quoit set, or other game to send to the gardens. Games, especially team games, are preferred to gymnastic apparatus, because they develop social responsibility and encourage physical development without endangering life and limb.

SCHOOL-GARDEN NOTES

BY H. D. HEMENWAY

Director of Hartford School of Horticulture

The United States Department of Agriculture is fostering a school-garden enterprise connected with the Franklin Normal School in Washington, D. C. The Department has given the use of one acre of ground, and a small greenhouse has been turned over to the teacher who has charge of the botany and garden work at the normal school.

Cleveland, Ohio, was the first city to distribute to the school children seeds in one cent packages. More than 140,000 penny packages were sold in 1904, and more than double that number in 1905. Forty schools in the city exhibit the fruits of their gardens.

The *Courier* of Evansville, Indiana, has given prizes for the best flower gardens produced by school children. Also for the best essay on "How a school boy or girl by home work can best improve Evansville."

The City Federation of Woman's Clubs of Saginaw, Mich., has stimulated the children in school-garden work by giving a $25 banner flag to the school which showed the best results with the facilities afforded them. This flag remains the property of the school winning it for the year in which it is won, but will be put up for competition each succeeding year.

At Amherst, Mass., the experiment of the past two seasons of having gardens for school children has been very successful. The children paid one dollar each for their gardens, instruction, and seeds. The gardens were 8 x 50 ft. each. The project was started by Mr. Hardy, Superintendent of Schools; and the practical work was in charge of Professor F. A. Waugh and his assistants of the Horticultural Department of the Massachusetts Agricultural College.

Joliet, Illinois, has eighty acres in public school grounds. These have over 30,000 trees on them. One school lot has a peach orchard in which the fruit ripens unmolested.

Superintendent O. J. Kern, of Winnebago County in Illinois, formed a Farmers' Boys' Experiment Club in 1892. This Club now has a membership of about 350 boys. Superintendent Kern arranges monthly lectures for the club in winter. One or more excursions are taken every year. Most of the boys have home gardens. Last season Winnebago Co. had school-gardens in 73 districts.

Ten new school-gardens were started in Minneapolis last spring. The University of Minnesota aided in the work.

It is said that in Cleveland, Ohio, sixty-five thousand children have gardens either at home or at school.

Prizes were given at the last West Michigan State Fair for the best exhibits of vegetables and of flowers grown in school-gardens, and in home gardens under school direction.

The pupils of one school in Newark, N. J., went into the peanut business to obtain money to buy seeds for the school-garden.

Walter D. Ross of Worcester, Mass., a seedsman and dealer in agricultural supplies, gave to the value of over $125 in seeds and fertilizers the last season to the Worcester schools for use in their gardens.

Thirteen school-gardens have recently been established at Grenada, West Indies, at a cost of about $825.

Thirty-five school-gardens, each connected with a high school where elementary agriculture and gardening will be taught, have just been established in the Philippine Islands by the Board of Education.

More than one hundred cities and towns in the United States now have school-gardens connected with at least a part of their schools.

School-gardens have been conducted in the Hawaiian Islands since 1849.

New York City has appropriated $5,000 for maintaining children's gardens in DeWitt Clinton Park in the summer of 1905.

The City of Philadelphia set aside $3,500 for maintaining and establishing children's gardens in that city. Probably the largest school-garden in the United States, if not in the world, is in Philadelphia. It covers four acres of land, and 1,200 children have a plot 12 x 15 feet each. It is conducted by the Civic Club.

The Schoolhouse Commission in Boston bought a lot adjoining the Hancock School, tore down the tenement which stood on it, fenced the lot and turned it over to the teachers for a school-garden. The Street Department furnished the sweepings and the children did the work.

Park land is used for children's gardens in New York City, Boston, Worcester, Mass., and Hartford, Conn.

The School-Garden Association, Station A, Boston, Mass., has been formed to supply one cent packages of seed to school-children. Its work is not confined to any city or state. A booklet of planting instructions is sent with each order.

The school-garden work at the School of Horticulture in Hartford, Conn., is attracting considerable attention. Besides persons from various places in the United States who have recently visited the gardens, there were a member of the School Board from London, England, a lady from Hamburg, Germany, and a lady from England. The latter remained for six weeks, taking a regular course.

A PLEA FOR THE WILD FLOWERS

[EDITORIAL NOTE.—The following notes from *The Plant World,* the official organ of the Wild Flower Preservation Society of America, deserve wide circulation among nature-study teachers, who in turn can reach the children.]

It is to the interest of everyone that beautiful and characteristic plants be guarded from extermination. It is believed that every one will be ready to aid in this work if once he or she fully realizes the danger with which these plants are now threatened.

It is not our wish to discourage unnecessarily the gathering of wild flowers and ferns for decorative purposes. We ask only that they be picked with care and discrimination. Such a flower, for example, as the blue-bell should always be cut with the scissors or a knife, rather than picked, to prevent its being uprooted; and, even when cut, care should be taken to gather it only where it grows most abundantly, that no picturesque tuft be so completely done away with as to set no seeds for another year. Where there is an especially fine plant or colony, or where there is a single plant or a small colony, why not leave at least half the flowers for seed, in the one case giving nature a chance to perpetuate and develop the best, and in the other helping nature to extend her work of beautifying our surroundings?

The pink lady's-slipper, or moccasin-flower, the purple fringed orchid, the calopogon, pogonia, and indeed all the orchids, should be cut (not picked) fairly high up the stem, leaving, whenever possible, the lower leaves intact.

If these flowers are not to be exterminated, they should not be gathered at all unless found growing very abundantly, and then only in moderation. Such fragile blossoms are more effective if not heavily massed, but arranged in a few sprays by themselves.

From the purchase of the rarer flowers, especially of the purple fringed orchid, sabbatia, fringed gentians, or mayflower, we urge every one to abstain. Children sometimes offer them for sale, innocently enough; but those who buy, and so induce the gathering and selling, are the most dangerous enemies of all rare salable flowers.

The bunch-berry is another plant which is less abundant now than it was a few years ago, owing, we fear, to careless uprooting; and it stands in need of protection.

Ferns, also, should be picked with care, and not too freely,

unless in spots where they are unusually abundant. The same caution should be used against breaking branches from shrubs and trees in so rude a fashion as not only to cause a temporary disfigurement, but perhaps a permanent injury. The hobble-bush, whose effective leaves and brilliant berries decorate gaily the woods of late summer, is frequently a victim to careless picking.

The flowers growing in the immediate neighborhood of the roadside are a joy to the many. Is it too much to ask that these be left to delight the eyes of the passer-by, and that the flowers desired for decorative purposes be sought a few feet from the highway or even from the trail? These roadside plants are constantly enjoyed by those who by reason of age or some infirmity could otherwise never see them. Were this once realized, few would hesitate to take the trouble entailed by half a dozen extra steps.

Many of the most effective flowers may be gathered, away from the wayside, without fear of doing any permanent injury. Daisies, buttercups, clover, wild roses, meadow-sweet, steeplebush, asters, goldenrod, and other vigorous and abundantly growing plants will yield ample material for decoration, and may be gathered almost with impunity.

To sum up we urge: (1) Moderation. (Not gathering too many flowers of the same kind in one locality.) (2) Care. (The use of scissors or knife.) (3) Judgment. (Guarding the roadside and conspicuous locations.) (4) Occasional total abstinence. (In case of especially rare flowers.)

AN APPEAL FOR THE BIRDS

Bills to prohibit the use of the new automatic shot-gun in hunting birds will be introduced in all Legislatures which convene next winter. The New York Zoological Society and the League of American Sportsmen have decided to send delegations to the capitols of these various States, to urge the passage of these bills. It will require a large outlay of money for travelling expenses, printing, postage, clerk hire, etc., to conduct this campaign properly, and all persons interested in the preservation of song, insectiverous, and game birds, are requested to contribute to a special fund which is being created for this purpose.

A new line of automatic shot-guns, consisting of five different

models, has lately been put on the market by the gun trust, which is backed by millions of dollars of capital, and it is understood that these people will spend any amount of money necessary in a desperate effort to defeat the legislation we have undertaken to secure.

The automatic shot-gun is essentially a market hunter's and a pot hunter's weapon. The decent sportsmen of the country are a unit in opposition to its use in the field; but it will require more than the combined efforts of any one class of people to shut it out of the market.

This appeal is therefore directed to all humanitarians; to all who believe in decency and moderation in the hunting of birds; to all who believe that a reasonable number of our birds should be spared each year in order that they may propagate their species; and finally, to the men and women of America who do not believe in the killing of birds for sport at any time. There are strong and cogent reasons why all shooting of American wild birds should be prohibited, at least for a time; but this is impossible at present. Then let us curtail the killing. Let us limit the number of birds which any man may kill in a day, and by all means let us provide by law that whatever killing is done shall be done with decent weapons.

There are good people in this country who are contributing millions of dollars every year for the establishment of hospitals, libraries, fresh air homes and excursions for the poor of the great cities, and for other worthy charities and philanthropies. Why should not a few thousand dollars be contributed by such people for the preservation of the bird life of this country? If poor children are to be sent into the country each summer; if consumptives or other sufferers are to be sent to retreats in the mountains to escape the ravages of disease; why not provide something for the preservation of birds, in order that these invalids or these poor children may be cheered by songs and sights which add to the attractiveness of their rural retreats? Why should not the insectivorous birds, which do so much to save the fruits and farm products of this country, be protected from the wretches who use automatic shot guns?

The great libraries are being provided with hundreds of books descriptive of birds and bird life. We should provide that people who read these books and who may afterward go to the country may have a chance to see the birds they have read about.

The automatic shot-gun is one of the most serious menaces ever instituted against the bird life of this country. It is a veritable murdering machine. Let us legislate it out of existence, and to this extent, at least, provide for saving a few of our remaining birds from destruction.

In Europe, where a careful balance is maintained between propagation and destruction, it has been found necessary to prohibit the use of all repeating rifles and guns. Let us not be behind Europe in this same measure.

Checks for this war fund should be made payable to the order of the New York Zoological Society, and mailed to the office of its Game Protection Department, 1269 Broadway, N. Y.

This appeal is signed by Henry F. Osborn, Vice-President, Madison Grant, Secretary, W. T. Hornaday, Director of the New York Zoological Society; and Ernest T. Seton, Vice-President, G. O. Shields, President, of League of American Sportsmen. [*Shields' Magazine.*]

NATURE-STUDY IN NEW ZEALAND

The following suggestions have recently been issued in the form of a circular to the teachers in one of the largest education districts in the colony. The suggestions have been adapted from an Interim Report to a Committee of the Educational Section of the British Association. The circular is intended to indicate the *Spirit and Method* in which teachers are to conduct nature-study, rather than to point out the subjects to be dealt with.

Suggestions for Nature-Study

Any development of nature teaching in the schools finds an easy starting-point in the object-lesson. But the object must be present if the lesson is to be real. If the elephant can be represented only by a picture, that is a reason for giving lessons about something else until it is possible to adjourn to a menagerie. Where flowers or stones are required, let them be provided in sufficient quantity to give every child a specimen. Let these be distributed at once, so that the children may start with their own observations. This will require training, and the teacher will spend much time in discussing with the children what is seen. He can range where he likes, provided he keeps in mind the

cardinal principles of *observation, experiment,* and *the spirit of inquiry.*

A good way of ensuring that children really do observe is to ask them to make drawings from the specimens before them. Drawings can be corrected more rapidly by the teacher than written accounts; but written accounts should also be asked for. Whilst the drawing is being done, there ought not to be any sketch on the blackboard which would serve as a guide.

Several teachers of repute have recently drawn attention to the cycle of the seasons as the best ruling idea for the arrangement of any scheme of nature lessons. There can be no better guarantee that the teaching really will be based on observation and experiment. In summer there is endless material. In winter it is more difficult to realize the opportunities of the moment; but the long nights favour astronomy, the bare earth suggests geology, the weather is always a source of anxiety and interest, the frost without, and fire within suggest lessons on heat and cold.

For younger children the topic for the object-lesson may very well be chosen from week to week, and may depend simply on what is most available; for the upper standards will rightly wish to plan some more systematic course. But this plan should retain some elasticity in order to fit with the season.

The study of living things from the experimental side may be regarded as suitable for elementary schools. It satisfies the following important requirements:

(1) It can be made experimental, and most of the experiments are such as can be repeated by the pupils. The experiments are often of a continuous character, and afford some training in measurement and recording. It is wise to emphasize the quantitative side of many of the experiments.

(2) The subject forms a connected series of lessons, the later work developing in right sequence out of the earlier.

(3) The experimental teaching in school is easily linked to the outdoor life of field and hedgerow with which country children are familiar. Again, it is illustrated readily by practical examples drawn from the work on the garden and on the farm *so that the children learn that school work may have a bearing on their after life.*

While plant and animal life form very generally suitable indoor subjects for elementary schools, there should be a good deal of

flexibility about the nature of the accompanying outdoor work. With some teachers gardening, with others field botany or geology, forms the accompaniment. The teacher should be encouraged to develop a specialty according to his own tastes and the advantages or restrictions of his locality.

It is now within the power of teachers to take the school out of doors for a lesson and to count it in the time-table.

Every syllabus that includes the shadow of a stick at noon or the nightly turning of the Southern Cross prescribes topics which it is impossible to treat practically in lessons held at 2:30 in the afternoon. But this is just the reason why the routine of school work may be broken to allow children to witness interesting or exceptional natural phenomena the times of the occurrence of which are not within our control.

In schools which possess a garden much can be done in it by the children. Simple experiments in assimilation, pollination, grafting, &c., can be tried. Where classification is studied the making of order beds by the children is a great assistance. When it is impossible to work in the garden, experiments may be carried on in window-boxes.

Excursions should be made to roads and fields at all times of the year. Even in towns it is possible to study the branching of trees and unfolding of buds and to become familiar with the aspects of different trees in winter, spring, and summer.

To give definiteness to outdoor work some questions to be answered may be set before starting to talk, and answers to them written out afterwards. Composition should be correlated with observation and experiment.

Those who are not naturalists by hobby may do much to encourage children by giving their moral support to the simple interests of the wayside. Children may be encouraged to bring curiosities with them to school. Many schools now have a rack of bottles to receive wild flowers picked on the way to school; a slate reserved for nature notes, where the first scholar who sees a flower, an insect, a migratory bird, &c., may enter the fact. Pots of growing seedlings may occupy the window-sills. Aquariums are always interesting, and a caterpillar cage might be tried.

The collecting instinct is sufficiently strong at the ages we are discussing. The collector is often a naturalist in embyro; he is therefore to be led judiciously into the paths of progress. In certain directions—notably bird-nesting—restraint more than en-

couragement may seem necessary; but numerous recent books illustrated by photographs of birds' nests show the possibility of teaching children to watch without destroying. The general line is to wean a boy gently from mere collecting to collecting with a purpose; to collecting and observing, and then to the collection of observations in a note-book kept for the purpose. Collecting is a great help to accuracy of observation, and the boy who brings back a collection of pebbles from the seashore or of grasses from a field will know far more about what he carries in his hand than a schoolfellow who has never troubled to pick up anything. Children may be encouraged to try how many different sorts of wild flowers they can find along a country road and to write notes on their differences and resemblances.

The collecting instinct is a great motive power, if rightly directed. It should be used to solve special problems; and, if prizes are offered, they need not be for the largest or best collection of wild flowers, but for collections illustrating insect pollination, seed dispersal, the habits of climbing plants, and so on.

Some serious defects which have been noticed in nature-study teaching as at present conducted are:

(1) An attempt is made to cover too much ground, hence experiments and measurements are shirked because they take time and involve preparation on the part of the teacher. Experiments are described instead of performed, and a drawing on the blackboard takes the place of realities. This is the commonest and most vicious defect in such teaching.

(2) Unsuitable objects are often taken, especially with the idea of being practical. It is of no use to dictate notes on haymaking to a class where there is no opportunity of seeing the process carried out.

(3) On the other hand, there is a great lack of system. A lesson on opening buds is followed by one on tadpoles or on the motions of the moon. For upper standards we think the course should become more systematic.

(4) When a definite course is chosen it is often overloaded with classification. The teacher seems to have the fear of a possible examiner before him, and is afraid to omit anything. Science is often supposed to consist of big words. "Amaryllis, fruit, a bilocular loculicidal inferior capsule" need not appear in the notebook of a boy of thirteen. [*New Zealand Journal of Education.*]

THE PHILOSOPHY OF NATURE-STUDY — A REVIEW

BY THOMAS H. MACBRIDE,

Professor of Botany in the Iowa State University

In his latest book, "The Outlook to Nature,"[1] the distinguished author, Dr. L. H. Bailey, presents us, in pleasing form, four lectures delivered in January, 1905, before the Twentieth Century Education Club of Boston. The book consists, accordingly, of four rather lengthy chapters, each devoted to a particular subject or group of subjects, each accordingly rather independent of the other. In other words, the book before us was written for the platform and not as a volume, and only with difficulty can the general title, however well chosen, be made to cover the whole.

"The outlook to nature is the outlook to what is real, and hearty and spontaneous"; and the whole of the first lecture, entitled "The Commonplace," is a plea for the interest which attaches to ordinary and neglected objects. The un-noted creatures of the field and farm, nor less the fields and farms themselves—these are the objects on which our lecturer would have us lavish our affection. To such appreciation, literature, particularly poetry, is an aid, although, in the judgment of the author, the poetry of the farm is as yet unwritten. Dr. Bailey, however, is at his best, not when dealing with these minor objects, but rather when he essays those themes which have moved the human heart in all the ages; the best thing in the book is the description of a sunrise on Mt. Shasta.

The second lecture is devoted to a consideration of the relative advantages of country and city, with emphasis on country. The several sub-divisions,—the garden, why boys leave the farm, etc.,—contain many excellent and practical thoughts, and are very suggestive. Nothing comes amiss in these lectures; the church, the state, politics, economics, the public health—all are discussed and generally with much sound sense and wisdom.

The third lecture, "The School of the Future," is a plea for the "school of affairs." It is urged that our educational methods, especially in rural and elementary schools, are less serviceable because they have less to do with realities, *i. e.*, with the material environment of the child. The school problem as it presents

[1] The Outlook to Nature, by L. H. Bailey. New York, The Macmillan Co. 1905. Pp. 296. $1.25.

itself in rural New York is presented, even to the daily schedule, and discussed at length. Unfortunately, while decrying the existing schedule our author fails to set up for us a better one to take its place, but discourages us by the remark:—"I have no desire to prophesy what the means or methods of the schools are to be"—this after a long chapter of criticism and many suggestions looking toward wider industrial training. No doubt our country schools may and must be made better, but is it not to students such as the author of this book that men are looking for some definite, practical suggestions as to how the improvement may be ushered in? It is no doubt very true that all phenomena and activities about us "are God's agents, relentless and ceaseless," but how use them? The stream dashes by us forever; but unless some one have skill to make a wheel, no flour of wheat will ever feed the sons of men.

The last chapter in the volume, "The Quest of Truth," is in defense of the theory of evolution. The chief lines of argument supporting the hypothesis are succinctly stated; and some objections, chiefly of a religious nature, are discussed in an optimistic, hopeful spirit.

The style of the volume seems to us very unequal, evidently affected by the conditions of original preparation and delivery. The writer has his audience before him, an audience that must perforce be entertained, and that has, at least for the moment, a personal interest in the speaker. This circumstance admits certain anecdotes and side-remarks which are less appropriate in serious discourse. The influence of Whitman is apparent sometimes, alike in matter and style, although in his better moments our author forgets all masters, and presents his thought in a forceful incisive way.

Dr. Bailey's choice of words is not always fortunate. The critical reader encounters "headlonged" on the first page, used as a verb intransitive; he finds scientist in quotation marks, but scuddled used as an adjective without any such visible warning. In verse, especially,—a form of composition to which our author appears by no means disinclined,—a certain nicety of expression would seem indispensable. Inaccuracies to be overlooked in hastily written prose are less pardonable here.

> "How the earth hung in its ceaseless place
> As it whirls in its orbit old."——

may in form be rhythmic but is certainly less clear in sense.

But these are minor defects in a volume that will be read with pleasure by very many to whom Dr. Bailey's argument for country living and thinking will come as a personal appeal, on every page reminding of those "enviable early days," for too many of us long gone by. But ——

> "Whosoe'er in youth
> Hath felt his soul to such delights give way
> Shall fell congenial stirrings late and long."

NOTES ON NEW BOOKS AND PAMPHLETS

Nature-Study. By F. Overton and Mary E. Hill, N. Y. American Book Co. Pp. 140. 40 cents.

This book consists of about thirty model lessons designed for pupils between eight and eleven years. The authors have carefully planned for the correlation of language with the nature work. The book is to be placed in the pupil's hands, and the questions for independent work are framed to call for immediate observation only—a plan which is more adapted to form a basis for English composition than to develop a scientific attitude.

The "Supplementary" work is unusually wide in its range and should form the major part of the work, as it demands *continued* observation and more reasoning than the "Observation" work. It will need a wealth of material as well as careful explanation on the part of the teacher.

The illustrations lack detail too often to be of themselves of educative value. There is a question whether the drawing demanded may not become monotonous.

As a rule technical terms have been avoided. Fewer incorrect or unscientific statements are given than in most books on elementary science, but most of us will take exception to such statements as "the bill of the housefly" (p. 16), "the petal and its seed" (p. 35–36), and "the sap is the blood" (p. 66).

Many familiar objects are interestingly treated, and the book as a whole is very suggestive. If science books are to be given to young pupils this is one of the best yet published.

JEAN BROADHURST.

STATE NORMAL MODEL SCHOOL,
TRENTON, N. J.

How to Know the Wild Birds. Special editions for Minnesota, Missouri, Illinois, Indiana, Ohio, Wisconsin, New England and the Northwest By D. Lange. Boston, Educational Pub. Co. 1905. 25c. each.

These booklets are designated to fill a long-felt want for brief introductions to birds in limited localities, especially for school use. No previous knowledge of birds is needed by the user of these books. The key is exceedingly simple, as follows: Land birds—(1) woodpeckers and other climbers, (2) other birds marked with red, (3) birds marked with yellow or orange, (4) birds marked with blue, (5) birds marked with reddish brown, (6) birds of the air, (7) birds chiefly colored black or black and white, (8) birds chiefly dull colored, (9) birds chiefly colored slate or grey, (10) birds colored brown or streaked, (11) quail, prairie chickens, and grouse, (12) eagles, hawks, and owls. Water and Shore Birds—(1) large waders, (2) smaller waders and shore birds, (3) coots, grebes, gallinules, and loons, (4) terns, gulls, and cormorants, (5) ducks and geese. The common species under these headings are described briefly and simply. Of course a booklet cannot be expected to be satisfactory in the case of birds difficult to identify, but these need not concern the beginner.

An introduction gives some good suggestions regarding identifying birds, "do not collect birds or eggs," care of injured birds, and nesting boxes and protection of birds. In some of the editions supplementary chapters deal with (1) birds of the world's literature—English robin redbreast, skylark, English blackbird, cuckoo, nightingale, white stork, and raven, (2) some common birds of Europe and their American relatives, and (3) scientific classification of the birds named in the book.

A comparison of the books for Ohio, Indiana and Illinois results, as might be expected, in the discovery that the few birds credited to one state and not to the other are usually rare and irregular. Perhaps a dozen foot-notes would have made it possible to unite the volumes for Ohio, Indiana and Illinois, and probably others.

Half Hours with Lower Animals. By C. F. Holder. New York, American Book Co. 1905. Pp. 236, 250 ill. 60 cents.

In this, the latest addition to the series of the Eclectic School

Readings, the story of lower animal life, including the protozoans, sponges, corals, shells, insects, and crustaceans, is presented simply. The narrative is untechnical, and popular in form. The volume is interesting and may prove useful as a supplementary reader in schools. Much of it would be a useful guide when spending a summer at the seashore. It is to be hoped that it will never be used as a text-book, for which it is said by the author to be adapted. A volume to follow will complete the survey of the animal kingdom.

Field Studies of Some Common Plants. Revised Edition. By C. H. Robison. Published by author, Mayville, N. D. Part I 50 pp., paper. 25 cents.

These "Outlines" are intended to direct pupils in out-door study. "They aim to tell the student exactly what to look at, and how to do so, without telling him what he is expected to see."

The topics are foliage leaves, stems, roots and trees in autumn. For these general subjects there are arranged outlines which include the most interesting points in the elementary text-books of botany. The book is certainly useful in connection with high-school botany and for nature-study teachers who wish a guide for their own studies and suggestions for pupils' work.

A second part on "Spring Flower Studies" is mentioned in the preface, but the reviewer has not a copy at hand. No doubt it has the points of excellence found in Part I.

Nature-Study and Agriculture. Circular No. 60, Office of Experiment Stations (free upon application to Department of Agriculture), deals with teaching agriculture in rural common schools and the progress of the movement for agricultural education is traced. As obstacles to general introduction of agriculture into rural schools, the circular cites: conservatism or apathy of school officers, teachers with little or no normal training, salaries do not attract professional teachers, rapid shifting of teachers, short terms. The practical remedy is consolidation of schools.

In a rural school with program of studies extending over eight years, the nature-study should be in six years, and elementary agriculture in last two years, each subject at least one hour per week.

"During the first two or three years in school the children should spend a short time each week in forming an acquaintance with the

birds, insects, flowers, trees, and other animal and plant life of the school-yard, the roadside and the wayside pastures and woodlots. This very pleasant and profitable way of gaining knowledge has been their principal occupation during the two or three years that they have been running about out of doors at home, and they should be encouraged and aided to extend their knowledge of the things in nature with which they are likely to come in daily contact throughout their lives."

"After the first year or two, the time depending on the progress the children have made, more attention should be given to studying life histories of plants and animals (especially birds and insects), so that these may be recognized in all stages of their development, and their economic relations determined. This will enable the pupils to decide whether a given species is mainly beneficial or harmful and will set them to thinking about means of perpetuating or exterminating the species. This last consideration is the one which mainly determines the attitude of the farmer toward his field crops, domestic animals and fowls, as well as toward the weeds and other pests that annoy him. When the nature-study teacher and her pupils have arrived at this point of view they will be in a position to pass over as unimportant such details as color of hair, length and number of teeth, number of leaves, length of petioles and internodes, and a hundred other peculiarities of plants and animals, except as these peculiarities have a direct bearing upon the perpetuation of the species or upon their usefulness or harmfulness to man."

With regard to elementary agriculture: "A well-arranged and up-to-date text-book, with illustrations and suggestions for practical exercises, should be adopted as a basis for this study. . . . The instruction in the classroom should be supplemented by simple experiments with soils, plants, and animals both at school and at home."

Many other points in this pamphlet will interest teachers.

School-Gardens. A valuable report on the coöperative work between the U. S. Department of Agriculture and the normal schools of Washington, with good notes on school-garden methods in fifteen other cities, is printed as Bulletin No. 160, Office of Experiment Stations. The price is 10 cents; for sale by Superintendent of Documents, Washington.

EDITORIALS

HELPING BEGINNERS IN NATURE-STUDY TEACHING

In various forms from several hundred persons has come the question whether THE NATURE-STUDY REVIEW is valuable for the general teachers in the elementary schools as well as for those readers—officers, special directors, high-school teachers of science, and college professors—who are interested in nature-study from the standpoint of the supervisor. One principal of a school in a small town writes: "Nature-study has been introduced into our school. Our teachers know nothing about it, and many of them can scarcely distinguish a grasshopper from a potato-beetle. If THE NATURE-STUDY REVIEW will give these teachers the help needed, we will subscribe for several copies." Essentially the same thought is expressed in more than a hundred other letters from teachers who admit that they feel totally unprepared for nature-study teaching.

Now, it must be obvious to all experts in nature-study that a magazine can not offer the best form of instruction for teachers who are beginners in both the subject-matter and the teaching of nature-study. Such persons will certainly do best to study first the subject-matter, with instructors if possible, otherwise with the guidance of some of the many books and leaflets intended for beginners. But those beginners who are earnestly striving to advance as far as possible will surely find much of interest and value in this magazine, especially in the practical articles which are published in every issue and which in the future will be more abundant. The editors are doing their best to make THE REVIEW interesting and useful to all groups of readers, beginners as well as experts; but to undertake to make it take the place of training-school courses for nature-study teachers would be as absurd as substituting a few volumes of education reports and journals for a regular program of studies in a normal school. Educational journals are commonly regarded as valuable for progressive teachers rather than for those who are preparing to begin teaching.

A MAGAZINE FOR THE LEADERS OF NATURE-STUDY

It must be clear from the foregoing that THE REVIEW aims primarily to reach the teachers who have already made *some* progress in nature-study and its teaching. But above all, it must

aim to be the organ for exchange of ideas from the leaders of nature-study. By leaders we do not mean simply the few people in a state who write articles, lecture, and conduct institute classes in nature-study, but also the teachers and officers who set out to advance the nature-study work in their own schools. Almost every school has a leader in the nature-study work. In addition to these leaders actually engaged in the work of the elementary schools, there are in the United States and Canada several hundred instructors in normal schools and colleges who are interested or engaged in the work of training teachers. For all these leaders in the nature-study movement THE REVIEW is of interest, because it stands for progress in nature-study. Papers on "Relation of Nature-Study and Natural Science," "Criticisms of Nature-Study," "Educational Aims and Values of Nature-Study," and similar topics will probably be of little interest to any but the leaders and special teachers of nature-study; but judging from comments so far received many of these agree with the editors that such discussions of fundamental problems deserve to form a prominent part of the contents of this journal in its first year.

EDUCATIONAL DISCUSSIONS AND SUBJECT-MATTER OF NATURE-STUDY

For the reasons stated above we have made educational discussion prominent in this first volume, and subject-matter has been somewhat neglected. The time has now come when it seems wise to devote considerable space to the facts, and henceforth the editors will welcome articles and notes which give information concerning natural things of interest in connection with nature-study. A beginning in this line is made this month in the new department entitled "Nature Notes."

OPINIONS OF READERS WANTED

THE REVIEW, like every other magazine, may be improved by suggestions from its readers. Please write to the Managing Editor your views as to the material published. Even a "*sensible abusive*" letter, recently suggested by a popular magazine, may be helpful, especially if it suggests something which readers want.

GUIDE TO PERIODICAL LITERATURE.

[EDITORIAL NOTE.—The unexpected delay in publishing this number has made it desirable that the "Guide" be omitted and brought nearly up to date in the next number.]

NATURE NOTES

[Editorial Note.—As shown by our "Guide to Periodical Literature," many interesting articles on the natural history of plants and animals appear in various popular and scientific magazines. Probably few readers of this magazine are able to read even one-half of the articles whose titles are attractive. In order to make the most interesting facts available to busy teachers, The Nature-Study Review will undertake to publish, as a regular department, brief abstracts of many articles on natural history and science. Readers are invited to help with this department by suggesting articles deserving notes, or by sending abstracts ready for printing.]

The Stupidity of Bees. A writer in a recent number of the *Outlook* calls attention to the "ignorance or stupidity" of honey-bees, citing such facts as the lack of concerted action in pulling and tugging, and failure to cooperate in releasing comrades from spiders' webs; but in building comb "every one helps his neighbor in building a cell," and it is well known that there is plenty of concerted action in defending the hive against intruders. As another example of "stupidity" the author cites the fact that the bees "do not know enough" to stay in the hive on cold but sunshiny days and thousands venture out and perish.

All students of the bees will certainly not agree that the above facts indicate "stupidity." Entanglement in a spider's web is a rare accident, not a regular event, in the life of bees, and one fails to see how an instinct leading to united effort in attempted release of an entangled companion could be of any advantage in a colony of 50,000 individuals. The instinct to go about their routine business, leaving the entangled individual to its fate, certainly is most valuable so far as the community as a whole is concerned. Not so in building comb and defending the hive. Here are events upon which depend the fate of the colony, not simply of a few individuals, and instincts have been developed accordingly. And so with regard to every other act which is important for the colony as a whole we find instincts which have led writers to comment on the "marvellous intelligence" of bees. The facts which suggest "stupidity" really go to prove that bees are machines, rather than intelligent organisms, and that the machines are "wound up" with instincts which cause them to run for the good of the community, perhaps neglecting the individual. A modern psychologist of the Lloyd Morgan school would deny that bees are "stupid," for this implies intelligence, which insects apparently do not possess.

With regard to flying out in mid-winter, it seems probably that this is due to abnormal conditions. It is well known that bees kept in cellars in winter often get restless owing to the over-loading of the intestine during the long confinement and a "cleansing flight" on a

bright, sunny day is recommended by keepers as a sure cure for the restlessness. It is doubtful whether thousands would venture out and perish if the hive allowed freedom of exit at all times and was properly managed and protected so as to prevent intestinal disorders of the bees. The case appears to have nothing to do with "stupidity."

Tree Planting by Railroads. The rapidly diminishing supply of timber for wooden cross-ties, as a substitute for which metal has so far failed, has led the managers of several great railroads to undertake the planting of trees to supply ties. The Pennsylvania is planting the yellow locust and certain western railroads the catalpa. During this year the Pennsylvania plans to extend its plantations to more than 100,000,000 trees; but these if fully grown would supply ties to this single railroad system for less than three years. It is said that in order to have a constant supply for the future this railroad must set more than a thousand acres with trees each year.

The Oldest Oak. The famous old oak at Cowthorpe, England, is the subject of an interesting article in the August *Plant World*. The tree has long been supposed to be over 1600 years old. In 1700 it was 80 feet high and 78 feet in circumference at the ground. It is now smaller, owing to decay, and probably can not live much longer. Comparing with other oaks, the trustworthy evidence is that the tree is not over 500 years old, instead of 1600, estimated on the theory that oaks grow one-twelfth inch per year—a statement now known to be inaccurate, because individual trees vary and young trees grow faster than old trees.

The Gypsy Moth. This imported (1868) insect which has for years been a pest in eastern Massachusetts, the caterpillars destroying the foliage of fruit and shade trees and causing great annoyance to human individuals with whose skin they came into contact, is again attracting attention. In 1900 the State Board of Agriculture abandoned the war against the moth, which in ten years (1890–1900) cost the State over a million dollars. As competent entomologists expected, the insect has developed rapidly since the work of suppression was stopped. It is scarcely possible to exterminate this introduced species, and "eternal vigilance" will be necessary. To ensure this there is needed legislation which will organize the fight on a permanent basis, and a bill which has been introduced to the legislature provides for cooperation of the State municipalities and property owners.

Quacks Among Plant Doctors. Professor Bessey, writing in the August *Plant World,* on Plant Pathology, advises that all patent medicines advertised to cure plant diseases be avoided. Write to your State Agricultural Experiment Station for free and the best advice. Among the causes of common plant diseases, the author cites (1) thirst—deficiency of water, (2) starvation—lack of proper

food, (3) poisoning from gases of the air (in cities) and harmful substances in soil (*e. g.*, excess of common salt), (4) wounds allowing entrance of injurious organisms, especially fungi, (5) loss of necessary parts (*e. g.*, leaves and roots destroyed by insects), (6) fungi, the most fruitful cause of disease (*e. g.*, blotches on fruits and leaves, rotting of plants internally and externally). It is this last class of plant diseases which requires medicinal treatment—most commonly by chemicals sprayed over affected parts.

Flowers which do not open. A recent paper (reviewed in July *Plant World*) by the German botanist Goebel, cites facts which lead to the conclusion that cleistogamous flowers are due to insufficient nutrition, and not caused by the lack of pollinating agencies, as has been commonly supposed. In other words, such flowers as the closed gentian originally failed to "grow open" because of insufficient suitable food and not as a response to a demand for special adaptation made necessary because insects for pollination were wanting.

City People in the Country. According to the passenger agents of several of the great railroad systems centering in New York, the present season has witnessed an unprecedented exodus to the country for the summer, particularly of people of moderate means. And an especially gratifying feature of this exodus, noted by these same agents, is the largely-increased number of people who are either buying or renting small houses surrounded by a few acres of land for gardening and light farming. One agent declares that the demand for these small plots along his line, convenient to the city, is far in excess of the supply. "They all want a house with a garden," said one of these men, "and the bigger the garden, the better it suits." How much more sensible and conducive to the comfort, pleasure and health of a family is a vacation spent on one of these small farms than in the ordinary country hotel or boarding-house need hardly be said. And where the distance from the city and other conditions are such as to permit a man of family to make his permanent home in one of these rural localities, where he may have a bit of ground to till in his leisure hours and days, the arrangement is still happier and more advantageous all around.—*Leslie's Weekly.*

Why our Common Weeds are Introduced Species. The fact that practically all the weeds seen growing in vacant lots, along roadsides, in cultivated and uncultivated fields in Canada and the United States, are introduced species, is known to botanists; but the reason why these introduced plants should become weeds and our own should not, is not so generally known or thought of. At a meeting of the Botanical Branch of the Ottawa Field-Naturalists' Club held last winter, Professor John Macoun explained the matter to everyone's satisfaction. Ontario and other parts of Canada were heavily wooded before the settler came and the native plants grew in the woods, along

the rivers' banks or in the marshes. When the woods were cleared away, the conditions were not favorable to the woodland species and they disappeared; but in their stead were found the weeds introduced from Great Britain and Europe, where for centuries they have been growing in field, in hedgerow, and along the roadside. These, finding suitable conditions, have multiplied with great rapidity in Canada. —*Ottawa Naturalist.*

The Light-Perceiving Organs of Plants. A German botanist, Professor Haberlandt, has recently published a book on this subject. It is well known that many leaves can place themselves at right angles to the light rays which strike them. The problems of this book are concerned with the explanation of how the leaves turn and curve to get into the proper position with relation to light. First, Haberlandt shows, by covering leaves with opaque paper, that the leaf-blade is most sensitive to light, and next comes the leaf-stalk. In the epidermis covering the upper surface of the leaf, Haberlandt finds the peculiar cells which he considers light-perceiving organs. He compares them with the single eyes of certain backboneless animals, and certainly the lens-shaped structures do suggest "eyes." A striking experiment with nasturtium leaves showed that the natural waxy leaves, which are unwettable, will change position, when light falls obliquely, but after washing off the wax with weak alcohol (said not to injure the leaves, but one feels doubtful) the leaves do not turn. This suggested to the author the interesting theory that the waxy "bloom" and "velvety" of leaves saves them from being "blinded" by rain. Of course, all such pioneer work requires more study before it can be regarded as established science. Some American botanists have expressed their skepticism concerning these statements.

Game Protection. The well-known leader in the national movement for the protection of game animals, Mr. G. O. Shields, has started a new monthly magazine, *Shields' Magazine,* which will be "devoted to game protection, nature-study [popular], and all legitimate indoor and outdoor sports." The editor proposes to continue the work of securing better laws and their enforcement against the butchers of game animals. It will be the official organ of the League of American Sportsmen, of which Mr. Shields is the founder and president. The magazine takes the place of *Recreation,* which Mr. Shields founded and conducted until last January, when bankruptcy proceedings (said by Mr. Shields to have been instigated by enemies made by his stand for game protection) forced the magazine into the hands of another editor and publisher. *Shields' Magazine* will, obviously, be the new series of the old *Recreation* as we have known it for years. We wish it success in the fight for protection of our game animals against the butchers who hunt "out of season" and with the barbarous modern rapid-fire guns.

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DEVOTED TO ALL PHASES OF NATURE-STUDY IN ELEMENTARY SCHOOLS

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Published by M. A. BIGELOW, Managing Editor

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IN ELEMENTARY SCHOOLS

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(*Continued on the third cover page.*)

THE

NATURE-STUDY REVIEW

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VOL. I NOVEMBER, 1905 No. 6

THE COMMUNAL LIFE OF ANTS

BY ADELE M. FIELDE

[EDITORIAL NOTE.—In No. 1 of this journal there was published a description of the ant-nests used by Miss Fielde in her researches. Readers who constructed the nests and stocked them have requested information concerning the habits of the insects. There is no popular account of the communal life of ants in the publications commonly available for teachers and students, and hence the present paper will be a valuable contribution to nature-study literature. Very many of the points in this paper may be easily verified by careful observation of ants kept in the nests already mentioned. In other numbers of THE REVIEW writers have urged that bees are suitable for schoolroom observation; but this and the earlier paper by Miss Fielde make it evident that the closely allied ants are scarcely inferior to the bees as subjects for schoolroom studies.]

Among the four thousand known species of ants the colors range from pale yellow through red, brown and gray to the intensest black, sometimes with parti-colored bands, and sometimes with iridescent tints of blue, green or purple. In size they vary according to species from that of a needle point to a length of two inches. Ants do not grow after hatching, the stature of each individual being determined while in the larval stage for its whole lifetime.

The ant begins its life in an egg, which resembles a small pearl. The eggs are viscid on their surfaces, and the ants put them together so that they will adhere in packets, which may be carried to parts of the nest offering suitable warmth, darkness and humidity. After a period of about twenty days for incubation, there issues from the egg a glossy, white larva that is transversely marked by twenty slight constrictions and that has hooks upon its surface permitting it to be securely attached to its fellows so

Camponotus pennsylvanicus. Magnified four diameters. A winged queen; one major worker (lower right); three minor workers; two males (on left), one showing the dorsal side and wings and one the ventral side (lower left); cocoons, with a worker-ant hatching from one of them; a naked pupa (near major worker) and several larvæ. A minor worker is carrying a larva (upper right). Photographed by Mr. J. G. Hubbard and Dr. O. S. Strong at the Marine Biological Laboratory, Woods Holl.

that an ant-nurse can conveniently carry a bundle of a dozen or more larvæ, holding the bundle in her mandibles, her jaws.

At the smaller end of the larva there is a mouth, and the young larvæ are so placed that their mouths project from all sides of the bundle. I have often seen two or three ant-workers engaged in supporting a bundle of young larvæ high above the floor on which they stood, while a fourth ant, carrying a drop of regurgitated food on the end of her tongue, passed along from one larval mouth to another, allowing the ant-babies successively to suck their fill from the regurgitated drop.

As the larvæ grow older the hooks drop off and the larvæ are laid in groups, assorted in accordance with size, on the floor of the nest. Morsels of insect flesh are sometimes laid by the ant-nurses upon the chests of the larvæ, who bend their necks and partake of this succulent food much as a human infant imbibes its bottle of milk.

The length of the larval stage of the ant varies greatly with temperature and nourishment, sometimes being as brief as twelve days, sometimes extending to many months. When the larva has grown to the bulk of an adult ant of its species, it becomes lethargic for a few days, then bursts its outer skin, and appears as a snow-white, soft, snugly-folded ant. This pupa may be naked or may be inclosed in a cocoon spun by the larva just previous to its period of repose.

The pupa-stage is passed in about twenty days and toward the close of this period the colors of the adult are gradually assumed. Then comes the beginning of active life, with a twitching of the legs and a wriggling of the head, that calls the attention of the ant-nurses and secures from them such help as may be necessary in freeing the young ant from its outer membrane, or for the unfolding of its limbs. It is cleansed, fed, cuddled, and tended with surpassing assiduity. The callow, the newly hatched ant, is usually paler in color than its adolescent relatives, but it soon acquires the hues and the vigor of complete maturity. When but a few hours old, the callow worker begins its life-long labor in the care of the eggs, larvæ and pupæ.

Ants may be either male or female; and females may be either queens or workers. Workers may have different forms and be designated as majors, minors or minims. Whether the ant be

Camponotus castaneus americanus, slightly magnified, showing five workers engaged in the regurgitation of food to their comrades, and four winged queens. From a photograph by Mr. J. G. Hubbard and Dr. O. S. Strong. From the *Biological Bulletin*, Vol. VII, p. 306.

male or female depends on the egg in which it has its origin. If the egg be unimpregnated, its issue will be a male ant; but if it be impregnated its issue will be a female ant. Whether the female become a queen or a worker depends on the feeding of the larva, the quality and quantity of nutriment required for the making of a queen being a secret known only to the ant-nurses.

Male ants are always winged, and are generally smaller than their queens. They are comparatively short lived, maturing a few days after hatching, and dying after a few weeks or months. None has been known to live longer than a year.

The queen is winged at her hatching; but loses her wings after mating. Under the attraction of the warmth and light discovered at the exits of the nest at swarming-time, she goes forth into the bright summer world, meets her mate, seeks a congenial habitation, drops her wings, and becomes the founder of a new community. She lays a few eggs in the safe seclusion of her abode, feeds the larvæ with regurgitations from her own internal store, and takes competent care of her first brood until the young workers are able to make their way into the surrounding area to forage for themselves and bring food to their queen-mother. With the assistance of her first brood of daughters, who are always few in number and diminutive in stature, the queen rears a second brood, greater in number and larger in size. As the years pass the community grows ever more populous, the daughter-queens ordinarily going away to found new colonies, while the daughter-workers, wingless and devoted to domestic duties, increase to millions in the ancestral nest. A single community of ants sometimes occupies an area hundreds of yards in extent, although there are species of ants of which the colonies are always small. In summer they go far afield foraging for supplies, and assiduously rear their young. In autumn they retire with their larvæ into the deeper recesses of their dwellings and there hibernate until spring.

Queens may live so long as fifteen years, continuing to lay eggs and to rear daughter-ants. Workers may live several years, and may lay eggs.

Every species of ant may be considered as hostile to every other species. This mutual aversion is based on differences in odor, all unfamiliar ant-odors being offensive to ants. If a few ants of one species are crushed upon a bit of sponge, their specific odor

may sometimes be discerned even by human nostrils. The odor may be acid, acrid, rancid, musty, pungent, or like that of some vegetable or animal oil. It arises from a substance exuded by

Camponotus pennsylvanicus worker. Magnification six diameters. From a photograph taken by Mr. J. G Hubbard and Dr. O. S. Strong, and retouched by Dr. J. H. Macgregor. From the *Biological Bulletin*, Vol. VII, p. 308.

the ants, and it may be transferred from one ant to another, either by smearing one ant with the juices of another, or by soaking the ants together in a small quantity of distilled water. If an ant

be smeared with the blood of another species, it may appear among its former comrades as a sheep in wolf's clothing and may be treated as if it were an enemy; or if it be smeared with the blood of a member of the community, it may be introduced into that community, where it is truly a wolf in sheep's clothing, and may for some days escape detection there.

It is probable that every species of ant has its distinctive odor, borne by every member of the species whether male or female, and that this odor excites the animosity of ants of other species than its own merely because it is unfamiliar. While ants of unlike species, having never before met, will attack and rend each other when brought together, it is possible to create a happy family including diverse species. In 1903 I took ants representing three different sub-families and sequestered them, within twelve hours after their hatching, in nests so small that the ants would naturally touch each other with their antennæ during the first five days of their lives, and I found that ants of many diverse species thus made acquainted with one another in infancy would live amicably together thereafter for months or years. These experiments proved that the natural hostility existing between ants of unlike species could be eliminated by a suitable education, and it also provided an explanation of the fact that mixed colonies of ants are occasionally found in nature. Such colonies probably have their origin in conditions that force the members into propinquity during the first hours of active life.

Ants have not only their specific odor, which characterizes each species and differentiates it in the ant-world from all other species, but the female ants have also a progressive odor which changes as they advance in age, and which is the cause of the separation of ants of the same species into distinct communities, hostile to one another. The male ant, who is welcomed into any community of his own species, probably bears no odor beside his specific odor. The queen ant doubtless gives to her female progeny her own progressive odor, modified by that of their father's mother, latent in the male. With an odor that, at hatching, is very nearly the same as that of their queen mother, the worker ants gradually change their odor, forty days being the minimum of time in which there occurs a change so great as to be noticeable by the ants themselves. This progressive odor eventually differentiates ant-

nests. The odor of the queen, the first occupant, becomes the earliest aura of the nest. As the community increases its population, the odor of the workers is added to that of the queen, and is diffused in the air. The ant that has been out foraging recognizes its home through the familiar odor there discerned, and it avoids the abodes of unfriendly communities because of its perception of their strange odor. No ant with a discerning "nose" need ever intrude upon an alien household. Should it do this it would be attacked and rent limb from limb. The laws of the ant-world require from every ant a strict adherence to its own colony.

If a female ant be dropped into its own nest, it waves its antennæ and hastens to join its former associates; but if it be dropped into an alien nest it flees away or hides itself.

The odor of the ant-nest is perceived through the air, but the odor or savor of ants, whether friends or strangers, are perceived by an application of the "nose" to the subject of examination. Ants have two similar "noses," the two antennæ or "feelers" that project from the face just below the eyes. These are the organs of the chemical sense, dominant in the life of the individual ant and in the affairs of the ant community. The uses made by the ant of this sense are singularly diversified, while the minuteness of its discriminations are almost inconceivable. Associated with the great power of memory possessed by the ants, it enables them to prosper greatly in the world, though they lack the sense of hearing, and have but very imperfect vision.

Within the ant community the queen is chief, probably because her comparatively large size makes her a center of familiar odors. Her odor is unchanging, and her daughter-workers recognize her thereby, even after years of separation from her. Ant workers will also recognize their queen-mother and identify her among several other queens, even when these workers have never before met her. They remember the odor that they themselves bore in their own infancy which is also the odor of their queen. They would likewise recognize their mother's sister-queen. The queen exercises no authority in the nest, but is always the object of chief devotion, and of sedulous attention. She abides at home, except at or near the time of her nuptials.

Worker ants of the same community enjoy each other's odor, lick and pat each other, cuddle, and exchange nourishment by regurgitations. They take care of the young, the product of the queen's eggs or of their own eggs, with no manifest partiality except for the largest. If their nest be raided by alien ants or prowling human creatures, the workers, if there be leisure for choice among the immature young, will flee with the oldest, the objects on which most labor and care have already been expended. The rearing of the young is a constant occupation which is followed with an amazing diligence by the workers. The defense of the nest is also constant, and intruders are attacked with a ferocity equal to that shown by any other creature in defense of its offspring. I have seen two ants battle through eighteen consecutive hours.

Food is brought to the nest from distances extending to forty yards or more. When an ant goes out it lays a path under its feet, and in returning it follows its own scent as laid down. If the path be washed or overturned for a space longer than the body of the ant, the returning traveller loses the way and runs to and fro until the scent is picked up. This scent is perceived through the air; for a very thin layer of earth may be made to overlay the path without it interfering with the traveller's homeward progress. Every ant lays down and pursues an individual path; but like causes, such as shade, temperature, or topography may impel a multitude of ants into the same route.

Ants probably orient themselves on their journeys by the sense of smell, as a blind man might orient himself on a known road by a compost-heap, a glue-factory, a hop-field and a rose-garden. But these directing odors come from very short distances, probably less than an inch at most. When ants go forth from the nest, they sometimes go back repeatedly, gradually extending their journey, and appearing as if trying to familiarize themselves with their means of orientation. The path laid down by an ant, if left dry and undisturbed, may be followed by her unhesitatingly after five days of imprisonment elsewhere.

Insects have had few tests applied to their power of memory, the shortness of insect life being generally preventive of long continued experiments in proving their mental capacities. Among the insects, ants are remarkable for longevity, and they therefore present exceptional possibilities for the work of the comparative

psychologist. After several years study of the habits and activities of ants, I undertook, in 1904, to induce the ants to tell me through actions, which always speak more loudly than do words, whether they remembered past experiences. When such an inquiry is to be addressed to an animal, it is but fair that the appeal should be made through the leading sense of that animal. If it be to the eagle it should be through the sense of sight; if to the mole it should be through the sense of hearing; if to the caterpillar it should be through the sense of touch; if to the sea-anemone it should be through the sense of taste. The leading sense in the ant is olfactory, and through this sense I naturally put my question to the ants.

Among the ants, the workers have been shown by dissection to have the largest brain, and I therefore chose the workers for my tests of power of memory. That I might know whether the action of an ant was influenced by memory, it was necessary for me to know not only the customary behavior of the ant but to know its individual experiences during its whole lifetime. I therefore took from among the many nests in my formicary such ant-workers as hatched in segregation at the same time, and sequestered two or more species together in a very small nest where their natural activities would cause them to touch each other with the antennæ during the first hours of life. Ants of species ordinarily inimical were thus made friendly, forming a mixed family whose congeniality was manifested by all sorts of serviceable offices customary among ants of the same community. After these ants had lived happily together for periods ranging from twenty to forty days, I sequestered each species represented in the mixed nest, putting each group into a new nest. I then kept each group in strict segregation up to the time when the odor of the other species, encountered only in their earliest days, should again be presented to them for recognition.

One mixed family consisted of large black ants and small brown ants, and these were separated for seven months. In bringing them together an extraordinary factor had to be reckoned with, the afore-mentioned fact that worker ants change their odor with advancing age, and that neither the black ants nor the brown ants would bear the same progressive odor that had characterized them when associated with the other species seven months earlier. So great in fact had been the change of odor

that when I introduced one of either segregated group into the nest of the other, the visitor was attacked with all the virulence that marks a meeting of strangers of these two species. But when I introduced into either group an ant of the same age, the offspring of the same queen as were their quondam associates in the mixed nest, then the visitor was received with every sign of ant esteem, including that of granting a participation in the care

A happy family of ants of four species. Photographed from one of Miss Fielde's mixed colonies established at the Marine Biological Laboratory.

of the cherished larvæ. It was plain that the ants recognized an odor that had not been encountered for seven months.

Into another mixed nest I put newly hatched small jet-black ants with amber-yellow ants, the two sorts being of different subfamilies. When they had spent about forty days together, I sequestered these ants, according to their species, in new nests. When the two groups had been separated for a year, each group received with cherishing hospitality the newly hatched offspring of the queen-mother of their former associates; but they killed their former comrades when these were introduced into their nest. These ants thus showed that they could remember a certain odor at least one year.

In four nests, I kept brown ants that were all of one colony, and sequestered at their hatching. One of these groups had been segregated three years, one group had been segregated two years, one group had been segregated one year, and one group consisted of newly hatched ants, when I introduced marked members of each group, one ant at a time, into each of the other three nests. In every case the older ants remembered the odor of the younger ants, and received them amicably, while the younger ants, never having smelled the odor borne by the older ants, fought the visitors with plain intent to kill. This experiment showed that the brown ants had a power of memory extending to three years. It is probable that ants recognize at any time during their lifetime an odor with which they have once become familiar.

These experiments also indicate that the ants do not recognize one another by the contour, for their form had not changed during the period of separation. Had they means of conversation relating to the past, we must suppose that they would at their second meeting, have talked of old times instead of tearing each other. The only probable explanation of their behavior is that they were repelled by an unknown odor in some of these cases, and were pleased by a recognized odor in other cases.

Workers of one of the species employed in my experiments are but an eighth of an inch in length, while the head is but a quarter of the total length, and the brain within the head is so small as to be invisible except with the aid of a lens. If a brain so small can record an impression of an odor and act on that impression years afterward, this fact indicates to us that but few particles of matter are required as a seat for the mental powers.

We do not know whether the ants exercise reason and imagination; but they certainly have power of memory which is a foundation for all the higher psychic activities.

Under the dominance of the sense of smell and the power of memory, every ant acts upon individual experience. But there are differences in the character of ants of the same variety and of the same external structure. Some have stronger local attachments than have others, and adhere more closely to an old home. Some are more assiduous in their care of the developing young. Some are distinguished by exceeding truculence, while others are surpassingly amiable. Some are sluggards, while others are markedly enterprising.

But all are good housekeepers. They keep their nests clean, allotting different parts of the nest to different uses and burying offensive substances that cannot be removed. In all the animal kingdom the ants most nearly approach man in the diversity of their activities, and in an apparent application of intelligence to the practical problems of existence.

THE STUDY OF DECIDUOUS TREES IN WINTER

BY CLARENCE M. WEED

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To one who has paid little or no attention to the subject it is surprising what distinctive characteristics the leafless twigs of our native trees and shrubs present. To a very great degree they are as easily recognized as are the leaves themselves. They furnish a natural and practical subject for nature-studies during the winter months. Such studies may well be begun just as the last leaves are falling, when the transition from the study of the leaf to the twig is natural. So far as possible twigs from the identical trees which have been studied as to leaves, should at first be taken. This is not always feasible so far as providing specimens for the whole school is concerned, for the trees may very likely be ones from which it is not desirable to remove many twigs. In such cases one or two of the twigs may be taken to hold before the pupils as illustrations, and the main supply be derived from the less valuable trees in the fields and woods.

In general the supply of material for the study of twigs may be obtained in any one of three ways. The twigs may be gathered by the teacher herself, by one or more of the pupils delegated to the work, or by the class as a whole on a field excursion. The solution of this problem may well be left to the special circumstances in each case. There is no reason why any one of the methods named should be exclusively employed. There are advantages in all three: The teacher who fails to go into the fields and woods occasionally is scarcely likely to be successful in her nature-study work in the schoolroom. It is a great advantage to have a definite object in view in outdoor excursions, and a walk of an hour or two will generally furnish sufficient material to last several days. In every class above the third grade, at

least, there are likely to be bright boys or girls who would esteem it a privilege to gather material for use in school, and they should occasionally be given opportunities to do so. The interest of the field lessons will be greatly increased when the children can be taken to some woodsy by-road where they can gather twigs of certain trees and shrubs for their future study, and the later study in the schoolroom will take on an added interest from the memories of the trip. The wise teacher will be likely to utilize as many as possible of these various advantages and will not tie herself down to any one method of procedure.

It is very desirable that each pupil be furnished for his own special use a twig of the tree being studied. Where the classes are small, having only twenty or twenty-five pupils in each, it is a comparatively simple matter to carry out this idea; but even where classes are double this size it is not very difficult to carry it out. In any schoolroom where serious nature-study is done—and to my mind no nature-study is serious which does not bring the pupil into intimate contact with the real thing—some place must be provided for the material to be studied. A table or wide shelf or even a window-sill, on the side of the room where the sun does not shine brightly through the window, should be set apart for the nature-study specimens, which will vary with the ever-changing seasons. The twigs may be kept to advantage in vases or jars containing water which will keep them in a natural condition for several weeks. Perhaps nothing is better for the ordinary schoolroom, which has no special facilities, than a dozen or more common glass tumblers of good thickness and as plain as it is possible to get them. These are inexpensive and serve very well as receptacles not only for the twigs but for flowers and leafy branches at other seasons of the year.

Tasting.—Those who have been much with hunters or other woodsmen of long experience must have noticed how often various trees and shrubs were determined by means of the sense of taste. In the case of many species the taste of the bark is one of the most certain characteristics and sometimes furnishes the easiest way to distinguish a given tree from others which resemble it. For example, the sweet birch or black birch may at once be known among the birches by the sweetly aromatic taste of the bark, and the wild cherries may be easily distinguished from the birches, the twigs of which they resemble, by the in-

tensely bitter taste of the bark. I see no objection to having the pupils utilize the sense of taste in this connection, providing the teacher has been careful to warn them against tasting the poison ivy and the poison sumac and has led them to recognize these plants at sight.

For young children this tasting of the twigs will be of great value in exercising the special sense of taste, and perhaps to a less degree it will have a similar value for older children. It certainly will give excellent opportunities for careful discrimination and will greatly lengthen the list of objects for taste images such as that given on page 143 of Professor Halleck's "Education of the Central Nervous System," in his admirable chapter on "Special Sensory Training."

It is very generally stated that the woolliness on the scales of the buds of trees and shrubs is for the purpose of keeping the miniature leaves and blossoms warm through the winter. Of course it is easily realized that such a thin covering would prove utterly inadequate in keeping out a freezing temperature from the delicate buds. The botanists seem to be generally agreed that such coverings are for the protection of the bud, but that this protection is primarily brought about by preventing evaporation from the tender tissues beneath the bud scales. It has been shown that when the ground is frozen so that no watery sap can get into vegetable tissues the injury from evaporation of the tissues exposed to drying winds may be very severe. Consequently it is found that plants generally protect their tender developing parts in some way which will prevent undue loss of moisture through the winter months. This seems an adequate explanation of the woolly structure of many bud scales, of the wax-like covering of others, and of the varnish coating of buds like those of the horse-chestnut.

Teachers should be careful to select from the mass of conjectures which pupils will make when asked to suggest explanations for facts in nature only those which are founded upon actual conditions that may so far as possible be seen by the pupil. An analogy may easily be drawn in this case between the wilting of a branch cut off and thus separated from its normal supply of moisture and the conditions in the frozen ground. Should some bright pupil ask how it is with the leaves of the hepatica and the trailing arbutus which are exposed through the winter months,

draw out from him the fact that these leaves so exposed are old ones which have very little moisture in them and which have practically finished their services to the plant the previous autumn, while the young developing leaves of the hepatica have their tender tissues protected from evaporation by a thick mass of velvety hairs.

The value of this twig study depends very largely upon the extent to which the pupil is led to utilize it as a means of self-expression. The wise teacher will see that there is abundant opportunity for careful drawings that bring out the special characteristics of the various trees and shrubs. She will also give the pupils practice in accurate and rapid verbal and written descriptions of these twigs and in this way let them get something of the precision of the scientific method. She will also have them mount neatly and artistically upon sheets of white or colored card-board short lengths of the twigs, labelling each with the name of the tree and the initials of the pupil who does the work. All this work will finally be incorporated into a booklet for each pupil.

After the twigs of a number of the trees of the region have thus been studied by the pupil the time is ripe for a field excursion in which the particular point of view is that of the appearance and manner of growth of the trees with whose twigs the pupils have thus become familiar. This is an obvious application of the primary law of apperception which must always be kept in mind if field excursions for school purposes are to have their greatest value. The pupils will be eager to find the trees they are in search of and when they have recognized them they will notice with interest the manner of growth of the tree, the character of the bark of the trunk and the general color effect of the trunk and branches. If during the autumn they have visited the same trees when the leaves were upon them, they will notice the striking differences between the leafy and the leafless branches.

The winter season also is an excellent time to teach something of the economic uses of the various trees. It is at this season chiefly that wood-chopping and lumbering operations are taking place, and in many localities the actual processes may readily be seen by the pupils. The study of any tree should not be considered completed until the various ways in which it is of service to man have been pointed out.

A DAY AT THE CHILDREN'S SCHOOL FARM IN NEW YORK CITY

BY FANNIE GRISCOM PARSONS (MRS. HENRY PARSONS)

Founder and Director of the First School Farm in New York City

Approaching 11th Avenue by way of 52d, 53d, or 54th Streets, one not having visited this section for a year is amazed at the transformation which has taken place. A most perfect park (De Witt Clinton) for a tenement-house neighborhood has sprung up as if by magic. Although not fully completed, there is no doubt in the mind of the student of sociology that here is a model for the world of a park that will meet the needs from the baby to the grand-parent. Entering from 53d Street, to the right is a playground for girls, to the left a duplicate for boys; to the west an open-air gymnasium with race track for men and boys. Still to the west is a beautiful building containing forty baths for both sexes. Still keeping on to the west and approaching a little temporary wooden gate, we are greeted by a bright-eyed boy or girl with a cheerful invitation to walk in and visit our farm. Noticing a blue ribbon on which is stamped, "Gate Committee," fastened to the jacket or dress by a button embellished by the picture of a potted plant, we feel that the speaker, although diminutive, has authority and we accept the proffered invitation. Entering the gate, we seem to have lost touch instantly with the boisterous glaring streets with their squalor and dirt and crowds. The cares of business or home drop from our shoulders as if by magic. Our guide walks a few steps with us to the roomy piazza surrounded by flower boxes and flower beds most artistically filled and arranged. We are here met by another bright-eyed boy or girl with a badge marked "Piazza Committee" and our ears are greeted with the cheerful saluation, "Will you visit our farm-house first. Kindly use the horse-shoe knocker." With a wee bit of timidity we raise this emblem of good luck and let it fall a little heavier than we intended. Instantly the door is opened by a boy or girl whose badge is marked "House Committee," and we are shown the mysteries of this charming bit of house-keeping. The long low-ceilinged room is divided by simple screens, made of clothes-horses covered with attractive cloth, which at will may divide as many rooms as may be desired. This day they did duty

The original farm-house which now gives way to the elaborate building shown on a following page. Here the children have learned model housekeeping.

to partition off kitchen, front hall and parlor. Our guide explained that they had had a busy day, cleaning and arranging the closets, scrubbing the floors and washing soiled clothes. The ironing table was being made ready for the snowy linen waving in the breeze and brilliant sunshine, from the clothes-line just high enough for such tiny housekeepers, or bleaching on the grass which they had planted with their own hands. The tea-kettle was singing a merry tune, for the little willing hosts or hostesses serve tea with sweet hospitality to guests every afternoon. Having entered our names in the guest-book, and viewed the beautiful Hudson and Jersey shores from the parlor windows, we are again passed from house committee thence to piazza committee and finally to garden committee, which latter furnishes us with a guide to explain the mysteries of the Farm. Down "Broadway," as the center path has been named, amid groups of busy little farmers each tending a claim 4x8 feet containing a stalk of corn in the center of a row of beets, to the right and left of which grow carrots, peas, lettuce, radishes, and onions, here and there a teacher holds the attention of an interested group as he explains the wonders of growth, soil, etc. Another is having children crush a leaf of the corn, to show how much water it contains; their amazement grows as they see the drops fall as from a wet cloth. Our little guide explains what hard work it has been to make the paths so straight and even, and how faithful they have had to be, under the guidance of their teacher, to make the flower beds look so well. The observation plots of grain, tomatoes, pumpkin, strawberries, potatoes, weeds, and the tool-house are all visited. Our tour of inspection over, we are escorted again to the shady piazza with the full intention of hurrying away, but the comfortable rustic chair beside the silver birch table and the appearance of a smiling little hostess bearing a tray containing a refreshing cup of tea, puts our intention to flight; we sip our tea in this quiet, restful, busy little world; the fascinating scene holds us in its spell; Wall Street, politics and strife forgotten; every moment is filled with quiet interest.

A little figure comes down "Broadway," rake in one hand, a big bunch of radishes in the other, the left eye sightless from a Fourth of July accident, his hair seemingly having taken fright at the start as it grows all askew, a variety of clothing much too small adding to the caricature meant for a boy. A couple of weeks

before he had come to the house asking what he should do with the blank book he held in his hand. He could neither read nor write, had never been to school, and was nine years old. He was placed in the Children's Aid School, shorn of his unruly hair, clothed, fed; and now with a winning smile on the unmarred side of his face he showed with great pride that he had learned to count and read figures up to fifty. Here and there boys and girls could be seen lying flat on the path near their plots that they might get a closer view of their beloved plants while writing in their diaries. At a signal from the teacher books and implements are put away, and a sufficient number of little people (one for each

DeWitt Clinton Park in New York City—a rubbish heap in 1902.

garden path) are formed in line, and at a whistle signal, they march rake over shoulder with a military air to the head of their section, at a second signal they turn about face to rake the paths, other little farmers following to gather up the piles of stones or rubbish. When this is finished, again they form in line and march to the pump where they wash their rakes and place them clean and shining in the tool-house. This ceremony of raking seems to excite an esprit de corps, straightens backs and limbs, and in quiet happy order the garden is emptied for the night.

The garden, begun in the rubbish heap in 1902, has been incorporated in this beautiful new park; and its westerly limit is graced by a beautiful building 200 feet long containing demon-

stration hall, a model housekeeping apartment, a storage room for garden implements, etc. Household industry and shopwork will be correlated with the garden. Materials for nature-study will be supplied to the schools, or can be viewed in natural surroundings.

Four hundred and fifty individual plots are now (July, 1905) planted; and upon the gathering in of the first crop, three hundred and sixty will be transferred to new owners for a second crop. Counting the housekeepers, the Farm will have given happiness and instruction to 1,000 children in a space 250x130 feet, so solving the problem of intensive farming successfully done by many children in a small piece of ground in the heart of a crowded city.

What makes this work so different from all other work of its kind? First its completeness in touching every side of social life. Work is not done for work's sake, but every day shows a completed task accomplished, within the scope of the child's ability and understanding, and necessary to be done. Some of the lessons taught to visitors as well as children are brotherhood, coöperation, self-respect, honesty, the power of courtesy and justice, economy of time and material, simplicity, the dignity of labor, that the task properly performed will bring well-earned rest, while the task poorly done is never finished; every side of social life is brought into play.

But the sun is sinking to rest over the Jersey hills, the strains of music from the band on the warship lying at anchor just opposite on the bosom of the noble Hudson reach our ears, the little farmers have wended their way home, and on all sides are indications that the day is melting into night. With reluctance we tear ourselves away, our intended fifteen minutes having stretched into hours never to be forgotten, joining the group of sincere and earnest instructors who, having removed the evidences of the day's work, file out the little wooden gate, simply closing it after them, leaving this beautiful garden nestling between the fine buildings to the right and left of it, with its toothsome vegetables and well raked paths to the care of the neighborhood—a trust which for three years has not been misplaced.

Another unique feature of this garden is the noble hearts it has found in the officials in every city department through two administrations. These men may look stern and unapproachable to the uninitiated, but the Children's School Farm has been the key to

The western side of the garden and a beautiful new building 200 feet long containing lecture hall, a model housekeeping apartment and a storage room for garden tools.

unlock the inner closets containing a wealth of hidden treasure, that treasure of human sympathy that has made this whole work possible.

As we pass again through the crowded streets to the cars, a feeling of exhilaration takes the place of the depression within us on our arrival, for we have witnessed a practical object lesson of the possibilities of a properly conducted park, with its combination of playgrounds, baths, gymnasium, and last but not least its School Farm, as a means for the training of children in manliness and womanliness and civic pride through the channels of recreation, pleasure and instruction.

TEMPERANCE PHYSIOLOGY SIXTY-SIX YEARS AGO

We are accustomed to think of the modern form of "temperance physiology" for elementary schools as an invention of people still actively interested in promulgating the gospel of temperance instruction for schools. A short time ago in a search for rare scientific school-books the writer found in an old book-shop in New York a copy of "Physiology for Children," by Jane Taylor, published in New York in 1839. It was evidently somewhat successful in spite of the fact that laws did not then require "temperance instruction," for five years after its first publication the twenty-eight thousand was printed. The twenty-second lesson, which occupies three of the ninety pages, instead of eighteen which would now be required, is certainly interesting; and we reprint it exactly as it stands in the original. It reminds us of some text-books still on the market and of many others common less than twenty years ago.

M. A. Bigelow.

"Effects of Ardent Spirits on the Body"

"How does drinking ardent spirits affect the stomach?

It deranges the stomach, and changes its natural form.

How is this seen?

If we examine the stomach of a person after death who has been in the habit of drinking, we shall see the inside of the stomach feverish and inflamed, and all the little vessels filled with sickly, black blood.

Do ardent spirits burn the stomach, as they do the mouth and throat?

Certainly, only much worse, as the hot fiery stuff *is kept in the stomach,* but soon leaves the mouth and throat. If the *burning* drinks should stop

as long in the mouth and throat, as they do in the stomach, the whole mouth would be in a blister.

Do they blister and make a hard crust around the stomach?

Always. The stomach of a drunkard is lined inside, with a *hard* crusty wall, which greatly prevents digestion and brings disease.

When the stomach is diseased, are other parts of the body affected?

Yes, the head aches, the lungs and liver are disordered, and all the body must be more or less injured.

What effect has drinking on the *liver?*

It enlarges the liver. In some places the liver of fowls is considered a great delicacy. Here the poultry-raisers feed fowls on rum (mixed with meal) to enlarge the liver. The liver of the drinking man soon becomes of a frightful, unnatural size.

What is the natural color of the fluid in the liver?

Bright yellow, but drinking changes it to a black, thick substance like *tar.*

How does drinking affect the brain?

It hardens it and shrinks up the arteries.

Is the heart injured by ardent spirits?

Drinking excites the heart to a very hurried, unnatural motion. This hastens on the natural wear of the system.

Is the blood injured by drinking?

Yes, it may be nearly destroyed, for ardent spirits deprive it of its bright red color, and thus take out its living principle. The blood of a drinker is much blacker than the blood of a temperate person.

Is there any nourishment in alcohol, or ardent spirits?

No, Alcohol is not digested in the stomach; none of it makes *chyle.* But alcohol, burning as it was taken into the mouth, is found in the brain and in the blood and in other parts of the system."

PLANTS THAT HIDE FROM ANIMALS

Under this title Professor Beal, of the Michigan Agricultural College, writes in the *Popular Science Monthly* an account of adaptations for protection of plants. His examples are interesting, but his interpretations often doubtful and they raise questions similar to those in the article " Protective Colors of Animals " in No. 4, July, of this magazine. Some examples are cited and discussed below.

" Plants retire beneath the surface of the ground and are protected from animals." This refers to bulbs, tubers and rootstocks in winter. " They are nearly sure to escape destruction by animals." As examples are named: Solomon's seal, dutchman's breeches, May apple, goldenrod, artichoke. These make us feel doubtful. What animals can be persuaded to eat the underground

parts of the first four plants named, even if dug out and placed conveniently; and as for artichokes and potatoes and other plants with edible underground parts, the ordinary domesticated pig has no difficulty in finding the parts "concealed" beneath the soil. In general, it is certain that the rodents are not fooled by such devices. At a certain experimental forest plantation in Connecticut it is said that squirrels and other rodents dig up a large percentage of the planted nuts and also dig down and gnaw the tender roots. In Europe dogs and pigs are trained to hunt truffles.

Similar examples are easy to recall, and we may seriously doubt whether rootstocks, tubers and similar underground structures have any significance in relation to concealment from animals. Were animals guided by sight alone, we might be more credulous; but just as in the question of protective colors, we must not forget the highly developed sense of smell against which a few inches of soil offers little concealment for an object in which animals have special interest. If one must draw some conclusion as to the relation between the plant and the animals in such cases, it would be more reasonable to say that the rootstocks and tubers are concealed beneath the soil in order to preserve them for winter use of certain animals which have no difficulty in finding them when wanted. Of course this is an absurd suggestion; but until we get more specific and conclusive evidence, it is no more so than the idea that plants concentrated beneath ground are especially protected from animals. Does any reader know of any plant which animals commonly eat which is demonstrably so protected?

The next method of protection is by water. "Mud turtles, certain fishes, water snails, larvæ of insects, eat aquatic plants, but most other animals are unable to reach them in such places." As examples are cited: pond lilies, arrow-head, pickerel-weed, cattail flag, bulrush and many others. Again one doubts and asks the question, What animals unable to reach these aquatic plants would eat them even if they were accessible? The reviewer has for many summers noticed many of these plants growing along the margin of a shallow stream where these plants were accessible to the ordinary domesticated herbivores, but even when other pasturage was extremely short the aquatic plants were rarely touched, even when young and tender. Of course such a plant

as wild rice or other grain-plant might be eaten, but what animal would eat bulrushes or flags even if they were placed on dry ground?

Another case of "protection by water": "Flowers of many species of plants as they project above the surface of the water are protected from most unwelcome insects." But what insects? Certainly only purely aquatic forms unable to fly; but what right have we to consider these "unwelcome" or affecting the flowers otherwise than might many others able to fly to the flower. To the student of animal life the whole idea of protection of flowers in this way appears to be entirely unsupported by reasonable interpretation of the known facts.

"By climbing trees and bushes many vines get beyond the reach of cattle." But how about these same plants when they are young, tender and attractive to grazing animals? If climbing is a device for protecting from animals, surely it is a very imperfect one.

"When scattered by bursting pods, the seeds are seldom found by animals. . . . The small size and inconspicuous colors make it certain that few of them will ever be found and destroyed by insects or mice. Plants of this kind are euphorbias or spurges, violets, peas, beans, witch hazel, castor-oil plants, balsams and many more." On this point a student of animals must comment as follows: First, the author omits mention of birds, the great seed eaters. Anyone who has ever scattered broadcast small and inconspicuous grains, even on a grassy lawn, and then watched common domesticated fowls or sparrows search for them will doubt whether bursting pods are significant as scatterers of seed so as to "hide" it from animals. Again, the insects which would destroy seeds are probably those which would find them readily in the course of their roving about on the ground. The same is true of mice. With regard to the seeds which are scattered by bursting fruits, it remains to be investigated whether or not they are eaten by animals even when not scattered. At present we must remain unconvinced that scattering seeds is important in "hiding" them from animals.

"Seeds mimic pebbles." As examples are mentioned the mottled castor-beans not easily found (by human eyes) when thrown on the ground. But other even more inconspicuous seeds are easily found by birds. It is not simply a question of deceiv-

ing the human eye. Still another case can be cited: On the coast of the Philippines a certain bush has beans resembling pebbles in size, form, color, hardness and with lines "suggesting stratification." "Undoubtedly this mimicy of pebbles has saved many a seed from destruction by fish, bird or reptile." Here again we must *doubt* until some one gives us more than imaginary basis for faith in this suggestion of mimicry in seeds. We must know first whether the seeds are effectively concealed from animals, and second, whether in each supposed case animals would actually eat the seeds if not mixed "concealed" in pebbles. What animals, for example, might be expected to be so foolish as to eat the pebble-like seeds from the Philippines.

The climax is the case of an iris of the far Western States. Its ripe seeds are said to rattle in the pods and imitate the rattle of the rattlesnake so closely that grazing animals invariably step back after hitting the pods, "and thus the green leaves of the plants are spared to work for future crop of seeds." Here is a difficulty in this case: The ripe seeds rattle only when mature, and hence during the long growing season there is no such "protection" to the leaves. Also—we ask for information—do the leaves actually remain and "work" for a next year's crop of seed? The whole case looks like a splendid flight of a naturalist's imagination.

On the whole, then, the interesting suggestions that plants hide from animals do not well stand testing. Real evidence does not support most of the cases imagined. Perhaps there are adaptations for hiding plants from animals, but the evidence is decidedly rare, and certainly not convincing.

This paper has been reviewed in considerable detail because it happens to represent a kind of teaching common in our elementary schools. We need more critical studies of all supposed relations of animals and plants. It is hoped that readers of this magazine will contribute notes on their own observations.

MAURICE A. BIGELOW.

FACTS DISCOVERED BY CHILDREN[1]

[EDITORIAL NOTE.—As a contribution to the discussion, which this interesting and important topic deserves, we print below some paragraphs which, by permission, we take from a letter by Marion H. Carter, the author of the book referred to in the July issue.]

The book-review containing my statement that "to-day it is almost beyond the bounds of human possibility that a child should discover an unknown fact in the sciences," distinctly stated that the *guide* is intended for children of the 4th, 5th and 6th grades, city schools. I used the word "children" to refer to ages in those grades and not to "high-school pupils," which Mr. Cockerell specifies in saying he does not see why they (the high-school pupils) should not be able to gather the observations, "acting always in a cooperative manner and under direction." I used the phrase in the common acceptation of common language in connection with the average possibility of the average child. And as such I trust it has been read by most readers, and that no one has supposed that I referred to the boy genius, or to a marvellous teacher acting on a miraculous opportunity. As the statement stands, it is, I believe, irrefutable under the law of probability.

When my critic advances as his own idea of "opportunity" that there are at the present moment "hundreds of species of bees and wasps nesting in and about New York," I reply that I have lived eight years in New York and never within my recollection have I seen either a bee or a wasp flying about loose. Yet my opportunities, abilities, interests, desires and intentions are in the matter of bees and wasps assumably far beyond that of any twelve-year-old, excepting always the boy genius interested in wasps and bees.

It may be pertinent, and of interest to those for whom the infant-discovery fetish is still persistent to state that in nearly twenty years as a teacher of all grades (seven as head of the Science Department of the New York Training School where over a thousand pupils, already high school graduates, passed through my hands) I have never known *one* to make any *original* discovery; nor one who even seemed competent *at the time* and with the materials at hand to make a discovery.

The sole exception in nearly three thousand former pupils was a boy of ten in a suburban school. He was called an "odd genius" in school, and he did discover by himself a great number of facts

[1] See discussion by T. D. A. Cockerell in this journal Vol. I, No. 4, July, page 163.

(all without exception previously recorded) and in the full belief that he was adding to the store of human knowledge. I gave him books and references trying to lead him to master all the known facts about the plants and insects he was studying alone. With what result? His interest rapidly waned. Toward the end of the year he remarked that "there didn't seem to be any use trying to discover new things for everything was already discovered."

It was a clear case of a genuine original interest drained away by the over-stimulation of ambition which a previous teacher had created; of a bright mind that properly led in the beginning to love knowledge for its own sake might have accomplished at twenty the immature and abortive desires of ten.

Though this is an extreme case, I have seen the same in scores of other children (to a less degree) and young people whose teachers had trained them in the Agassiz method.

I made my statement in its pedagogical application because experience has shown me that if you mean to build solidly for the advancement of science you must build on what is already known; and the only people who have ever advanced it are the people who "know the literature." Those unrecognized unappreciated "geniuses," cold-shouldered by an envious world, who have to induce nice, rich, old ladies to build them private laboratories that they may give unheard of discoveries to a startled public usually end just there—with unheard of discoveries. As *vide* Keely, of motor fame, and many others now living.

It is a plain cold provable fact that the man who does not, or will not, or cannot find out what others have done on a subject before he goes plunging ahead on his own account—who does not "know his literature" down to bed rock—has hardly the ghost of a chance of making his standing in the scientific world of today.

Of course if your aim is merely to produce a gilded science youth, a dilettante and a loiterer, say so and be done with it. But if you are training minds for the advancement of science then you must put them on the main road from the beginning. And I contend that a youth whose observation has been trained as part and parcel of the habit of verifying the work of others has at twenty a potentiality for ultimate success far and away beyond that of a youth who has been trained to depend on his own discoveries, even though some by a happy chance may be new.

The sole value that can be urged in behalf of the discover-for-yourself method, which is the Agassiz method, is that it develops self-dependence and at a fearsome price. It is the method for the few who are able to survive it, not for the many; for the child of the visual mind type, not for the oral or motor.

I remember some years ago meeting a pupil of Agassiz's (a man now noted) who said to me "I gave up teaching by the Agassiz method when I began my own work because it was too expensive for average men. The world hears of the brilliant ones who succeeded under Agassiz—they would have succeeded anywhere. It never heard of the scores of average men who fell by the way-side—the men who needed to feel ground under their feet, to know that they know as they go along. I have seen good fellows in my class give up in despair with Agassiz—they did well everywhere else."

What, in the long run, is self-dependence worth that is bought at the price of arrogance on the one hand or despair on the other? What, in the long run, will it do for the advancement of science? Not enough to make the game worth the candle.

But the touch-stone of the whole problem is this: *Scientific knowledge* is *corroborable experience*. There are many kinds of experience, but science cuts out for her own that which is corroborable, and that element is the basis, the inalienable essence of a "scientific fact." If I say "I see a horse," it is supposable on the instant that you and that every other person with eyesight can see that horse by looking where I see him. *But,* if you or they look and do not see my horse, then my seeing is an hallucination.

Hence it follows that your pedagogical procedure is laid out with almost mathematical precision: You must work for the deepest possible sense and feeling of corroboration if you mean to build a solid and advancing mind. Then, and then only, will you have created a self-dependence as a sense of *knowing that I know* on which every vital nature will build its own original contribution with assured touch when the time is ripe.

I ought perhaps to add that in my early years I taught by the Agassiz method exclusively. One day I awoke to the fact that my poor and average pupils had dropped out of the running while the best had but the flimsiest mental stuff in them. After that for years I experimented to find a method which should build for the ultimates, not for the hour, and "Nature-Study with Common Things" was the result—tried with a thousand pupils—in one small field.

BOOK REVIEWS

Special Method in Elementary Science. By Charles A. McMurry. New York: Macmillan. 1904. Pp. 275. 75 cents.

This well known writer on methods has come forward in the present volume to help lighten the burden of the teacher of nature-study or "elementary science." Professor McMurry, in common with

not a few other interested observers of the nature-study movement, has been impressed apparently with the flabby, anemic, catch-as-catch-can affair which passes for nature-study in some schools, for he says, "the freedom and confidence with which teachers, high and low, recommend observational and experimental science, and the modesty and scarcity of those who succeed in such teaching, almost suggests the old fable of the belling of the cat."

In the chapter on 'Method in Science Lessons' the teacher will find valuable suggestions which should aid him very materially in revivifying and strengthening his nature-work. The coordination of nature-study with other subjects such as geography, history, manual training, etc., is advocated. One of the author's main objects is to select and arrange a suitable basis for bringing the child into contact with the practical problems of modern life. In his own words, "the materials for investigation spring better out of the contact with life's needs and necessities, than from the artificial conditions of the laboratory."

He attempts at the outset to minimize the confusion of the teacher placed amidst "the endless multitude and diversity of objects and forces," by citing him, as the rational source of material, to the relatively few points in the child's environment "where his interest and activity are strongly concentrated." Thus, he shows how a few centers such as the home, the local town, the school, the surrounding wild nature, and a few of the primary human occupations will supply all necessary data and material for nature-study or a simplified course in science. In a succeeding chapter a number of valuable suggestions are offered for planning a course of study for the eight grades, based upon these natural centers of the child's environment, and several practical lessons are appended for illustrations.

One greets with satisfaction the idea maintained throughout the book that "the course of study for the eight grades must reveal a rational, well-matured plan. . . ." About a fourth of the volume, indeed, is given up to laying out such a course of study. Not only are specific materials suggested and discussed, but the author endeavors so to arrange them that they will supplement the pupil's other studies. To the outline of the work for each grade is added a list of references so that the teacher may find adequate information about the material specified. This is still farther supplemented in the final chapter by a very full, classified list of books which are valuable aids in science teaching.

MICHAEL F. GUYER.

UNIVERSITY OF CINCINNATI.

First Book of Farming. By Charles L. Goodrich. New York: Doubleday, Page. 1905. Pp. 259, 86 Figs. $1.00.

This is the golden age of agriculture from the intellectual, if not financial, point of view. Books on practical agriculture and books on the aesthetics of agriculture have quite revolutionized our attitude toward farming—"the business of getting a living from the soil"—and today as never before the very name of farmer is quite as consistent with our ideas of culture and education as those of lawyer, doctor and minister, which have long been accepted as indicating learning. No wonder then that the author of this book is proud that he is a farmer. On the title-page we read, "Charles L. Goodrich, Farmer"; and in small type following is mentioned the position at Hampton Institute which Professor Goodrich long held with great credit to himself and to the institution.

The "First Book of Farming" aims to assist teachers, farmers and students in their search for the fundamental truths and principles of farming. Considering plants "the central and ill-important factor or agent," the author devotes Part I to the general principles underlying plant culture. After a chapter containing a brief introduction to plants, the root is taken up as the most important part of the plant and then follow in logical order: soils, water, temperature, plant food in the soil, seeds and their planting, preparing the soil, leaves, stem and flowers. All these topics are treated in a very simple, direct style, and the numerous illustrations and suggested experiments make the way to a correct understanding of the leading principles of agriculture easy for any average intelligent reader.

Part II deals with soil fertility as affected by farm practices, first explaining the nature of a fertile soil and then its relation to water, cultivation, manures and fertilizers, rotation of crops and drainage. Under all these topics the philosophy of the best practice and practical directions are clearly presented.

As will be seen from the above outlines, the book is limited to the plant side of farming, and there is no special reference to the useful and injurious animals of the farm. However, plants come before animals, and these latter naturally belong in a "Second Book of Farming."

The most inviting feature of this book is the simple and direct-to-the-point style. Instead of the complex narrative in which the leading facts are largely hidden, everywhere in the book the problem and its answers stand prominent in concise sentences. Here we can get the concentrated facts minus the opinions and theories which only confuse the beginner. For the general reader there is no better book, to teachers of elementary agriculture and school gardening it will be valuable for suggestions, and for the pupils of upper gram-

mar and first high-school years the book will be a strong competitor for the existing books intended for school use primarily.

M. A. B.

The Nature-Study Course. By John Dearness. Toronto: Copp, Clark Co. 1905. Pp. 206, ill. 60 cents.

The full title of the little guide from the pen of the vice-principal of the normal school at London, Ontario, is "The Nature-Study Course, with Suggestions for Teaching." It is based on notes of lectures to teachers-in-training.

The first thirty-three pages are concerned with the aim and method of nature-study, including topics such as: nature-study and science, object lessons, value and aims, modes of expression, correlations, selection of topics, and arranging courses of study. This part of the book is of general interest and will well repay reading by all who are seriously interested in the educational problems of nature-study.

The greater part of the book is filled with suggestions for teaching the course adopted for the public schools of Ontario and Manitoba. This part of the book contains an abundance of information, notes on methods, references and altogether it constitutes a very practical series of lessons for teachers-in-training. One feature not common in nature-study guides is a series of very practical lessons on the stars and constellations. We have drifted too far away from the old-time popular astronomy and this suggestion for a turn backward will be welcomed by many.

M. A. B.

Cornell Nature-Study Leaflets. Albany: Lyon Co. 1904. Pp. 607, 382 figs. $1.25.

This is a selection, with revision, from the Teachers' Leaflets, Home Nature-Study Lessons, Junior Naturalist Monthly and other publications issued from the College of Agriculture of Cornell University in the years 1896 to 1904. Altogether there are eighty leaflets in the collection. Forty-nine of these are "designed to aid the teacher with subject-matter, to indicate the point of view, and to suggest a method of presentation"; and the others are children's leaflets, "designed to open the eyes of the young." Comment on these world-famous leaflets is unnecessary here, and this notice is placed under book-reviews in order to call attention to the fact that the leaflets which have for some time been out of print are again available.

M. A. B.

School Gardens for California Schools. By B. M. Davis. State Normal School at Chico, Calif. 1905. Pp. 79, paper. 50 cents.

This is a manual for teachers. An introduction of ten pages deals with history of school-gardens and educational value. Recognizing that to grow plants requires an intelligent knowledge of the needs of a plant, the relations to soil, fertilizers, temperature and plant enemies are next presented. Then follow condensed notes on plant propagation, preparation of soil, cultivation, irrigation, tools, garden plans, planting calendars, time required, teacher's plan-book, pupils' records, and many other little points which beginners with school-gardens want. The suggestions on correlation are good. The final pages contain well-selected lists of books and bulletins for schools and references on the common insects of California. While the pamphlet is directly valuable for teachers on the Pacific Coast, its usefulness is by no means limited to that region.

M. A. B.

GUIDE TO PERIODICAL LITERATURE

A BIBLIOGRAPHY OF THE LEADING MAGAZINE ARTICLES OF INTEREST IN CONNECTION WITH NATURE-STUDY
JULY TO NOVEMBER, 1905

ARRANGED BY ADA WATTERSON YERKES

30½ Mellen St., Cambridge, Mass.

1. EDUCATIONAL AND GENERAL DISCUSSIONS OF NATURE-STUDY

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NATURE NOTES

[Editorial Note.—Readers are requested to send brief notes, signed with name or initials, for this department. Or please call attention to new articles deserving brief abstracts.]

Drumming of the Grouse. How and why the ruffed grouse drums has long been a mystery to naturalists. The most ancient and most generally accepted theory is that the drumming results from the bird pounding on a log. But this has long been doubted because the birds may drum standing on sodden and mossy logs, on rocks, or on the ground, and moreover the best observers have stated that the birds stand so erect that the wings do not touch the object on which the bird stands.

Professor Hodge has been raising grouse in captivity and has succeeded in taming them so that he has been able to observe the drumming birds at close range and to take dozens of snap-shot photographs. He proves beyond the shadow of a doubt that the drumming is made by striking the wings against the feather cushions of the sides. Moreover, the fact that a young male drummed first and afterwards only when the hens were removed, proved it to be a mate call. The bird had no opportunity to learn from older birds and therefore the reaction is inherited, not learned by imitation. This and many other interesting points, with photographs, are given in *The Country Calendar* for November.

Butterflies at Rest. Since I wrote the article "Do birds eat butterflies" (No. 5, September) I have been watching butterflies at rest. I find Pieris resting on large leaves in conspicuous positions. The white contrasting with the green, they are very easy to see and should be seen by the birds, one would think. Are they perhaps not eaten much? Of course the position, while exposed, is one in which the bird could not well perch to take the insect without alarming it; and it would perhaps be difficult to take it when the bird is on the wing. Also, I find Pyrgus resting on plants, looking quite conspicuous,—at least to me.

These remarks are made with the idea that perhaps The Review might collect all observations, however trivial, on the subject of the relation of birds and butterflies and some day edit the result for the readers. Something valuable might be accomplished thus.

T. D. A. Cockerell.

Birds Eating Butterflies. In regard to the matter of birds eating butterflies mentioned in the September issue it might be well to put my experience on record. In 1898 I spent two weeks at a country place upon the veranda of which a phoebe-bird had built her nest in plain view. At the time of my visit there were four fledgelings in the nest and these the mother bird fed principally on butterflies. This is not a mere matter of recollection for I wrote down the occurrence at the time. What made the incident especially striking was the fact that the old bird did not quite kill the butterflies nor remove their wings and as a result we were often treated to the sight of a young bird holding a butterfly whose wings were still waving desperately. After the butterflies had ceased to struggle, the young birds often sat for some time with a butterfly's wing projecting from each side of its bill. The butterflies were the common yellow and white ones so common over grass fields, cabbage patches and along roadsides. If one were to try to decide whether this is a common occurrence, I think it would be well to watch only certain birds such as the fly-catchers and their kin. To me it seems likely that strictly insectivorous birds may capture a large number of butterflies each season.

WILLARD N. CLUTE.

Vitality of Seeds. Twenty-five years ago Professor Beal, of Michigan Agricultural College, placed seeds of twenty-three kinds of plants in moist sand in uncorked bottles planted, mouth downward, twenty inches deep in a sandy hillside. Some seeds of each kind were tested quinquennially. All acorns were dead in two years. Eight kinds failed to germinate at the end of five years and thereafter. Eleven germinated after twenty-five years. Among them were black mustard, shepherd's purse, evening primrose, curled dock and common purslane.—*Botanical Gazette.*

Cock-spur Thorn. Dr. Leavitt, writing in the October *Plant World,* states that the great majority of the thorns of Crataegus Crus-galli point downward or curve downward. His interpretation of the usefulness of these peculiar modified branches is that they are defences against animals—ox and deer families—which now or once fed upon the leaves. The downward-pointing thorns are supposed to be especially valuable because these animals commonly seize branches from beneath. This explanation seems almost too perfect to be true. No doubt the trees are well defended by the thorns as arranged, but some biologists will doubt whether the relation between the plants and the animals is intimate enough to be of great moment in preserving the thorn-tree in the struggle for existence in the past. An explanation which appeals to many is that the thorns arose originally as a

mutation, that is, a sudden variation, and without any regard to their possible use in defence. This latter on this view is secondary and incidental and the species might have been preserved, as have many others, without such defences. This is quite a different thing from regarding the thorns as of great importance in the struggle for existence.

Gypsy Moth Parasites. The law regulating the importation of new species of animals has been temporarily suspended by the Secretary of Agriculture in the case of specimens for study and experiments by the Superintendent for Suppressing the Gypsy and Brown Tail Moths. Another attempt will be made to find a parasite able to control these exceedingly noxious insects.

What Kills the Birds. E. H. Forbush, Ornithologist of the Massachusetts State Board of Agriculture, writes in a special report that the principal natural enemies of birds are cats, foxes, crows, English sparrows, hawks, jays, owls, weasels, skunks, snakes, pheasants, minks, orioles, chipmunks, raccoons and the elements.

The detructiveness of the cat is noted not only by the greatest number of observers, but, with remarkable unanimity; nearly all who report on the natural enemies of birds place the cat *first* among destructive animals. Cats in good hunting grounds average at least fifty birds, each, a year. Cats are also more destructive than other animals, because so much more abundant. A friend who was raising pheasants was obliged to kill over two hundred cats in a few years. Game birds suffer much from the cat, but the smaller birds suffer more. Cats are far more destructive to birds than foxes are, for cats climb trees and take the young out of the nests. They easily catch young birds which are just learning to fly. They frequently catch the adult birds on the ground when they are feeding, or when they are drinking or bathing.

The most harmful characteristic of the cat is its tendency to revert to a wild state. If a dog loses its master and can not find its home, it seeks to form the acquaintance of a new master; but the cat is quite as likely to take to the woods and run wild. It then becomes a terror to all living things which it can master. Whoever turns out or abandons a cat or a kitten in the country has much to answer for.

Proofs of the destructiveness of cats are not wanting. They were introduced on Sable Island, off the coast of Nova Scotia, about 1880. They ran wild, and, multiplying rapidly, exterminated the rabbits which had been in possession of the island for half a century.

On Aldabra island, about two hundred miles northwest of Madagascar, cats are common. They have decimated the birds, and have ex-

terminated a flightless rail, an interesting bird peculiar to this group of islands. Cats are also numerous on Glorioso island, and, as a consequence, birds are even less common on this island than Aldabra.

Fifty-eight reports received by this Board name the fox as one of the most injurious enemies of birds, thus placing it next to the cat in destructiveness.

Many observers have found that the foxes kill many ground birds, such as grouse and quail, when there is snow in winter. It is well known that foxes will follow a man's track, and several students of birds have noted that foxes follow them and take the eggs and nestlings from nests which they stopped to examine.

NEWS NOTES

New Law Protecting Birds. A New York law taking effect in June, 1905, forbids unnaturalized foreigners to carry firearms and dangerous weapons. Under this law the slaughter of song and insectivorous birds, which has been carried to such an alarming extent by Italians, Poles and other foreigners, may be almost wholly stopped, if good citizens will make the proper reports to the civil authorities.

Hartford School-Gardens. The boys and girls who had gardens during the past year at the School of Horticulture, Hartford, Conn., held an Agricultural Fair. One interesting feature was a spading and hoeing contest, and prizes were awarded to those who best handled the tools and accomplished the required amount of work in the best manner and shortest time. Prizes were awarded also for the best kept gardens and the best arranged display of produce.

Rural Education. The New York Legislature of last winter voted $10,000 for lectures on this subject at the Farmers' Institutes to be held this winter.

Dr. E. F. Bigelow, of *St. Nicholas,* is giving during this winter a series of lectures to teachers' associations in California.

Protecting Song Birds. The laws against killing song birds are being enforced within a radius of fifty miles of New York City. During October and November many arrests, mostly of Italians, were made by agents of the New York Zoological Society and the League of American Sportsmen.

Automatic Guns. The New York Association for Protection of Fish and Game has unanimously passed (Oct. 13) a resolution and petition to the legislature protesting against the introduction of the slaughtering machines known as automatic shot-guns. A new law in the Province of Alberta prohibits all machine guns for hunting birds.

American Bison Society. This association has been organized for protection and increase of bison. Dr. Hornaday, Director of the New York Zoological Park, is president.

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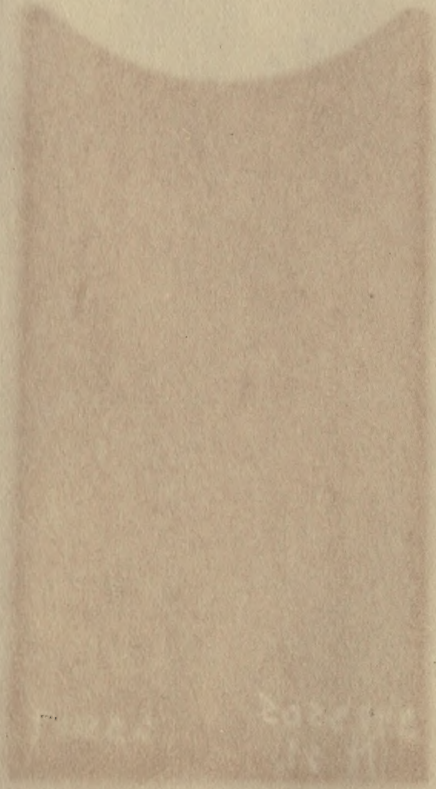

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